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SPELLING DISABILITY CORRELATES I—FACTORS PROBABLY CAUSAL IN SPELLING DISABILITY*

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Editor's note: The author presents a survey of researches relating to spelling disability in which he considers not merely the individual symptoms but the pattern of these in relation to performance.

THERE are undoubtedly a large number of factors operating in the syndrome known as spelling disability. Some of these play an important role only in individual cases; others are apparently operative to some extent in practically all cases. Perhaps an individual consideration of each factor dilates its significance for each has importance only because of its interrelations with the others present, rather than because of its presence per se. The pattern of the factors operating in each case is certainly greater than the sum of the individual symptoms. However, it is necessary to know what symptoms to look for and their probable significance in order to interpret the syndrome of spelling disability.

In attempting an evaluation of the various factors, the writer has arbitrarily divided them into the areas of the physical, the intellectual and temperamental, the subject matter and the miscellaneous. In the discussion of each group, the indications of relevant research are interpreted. Unfortunately, space does not permit the repetition of the characteristics of each experimental study cited. The number of studies mentioned often makes it necessary to summarize merely rather than to examine critically. However,

* This is the first of two articles giving a concise summary of the evidence concerning various factors in the etiology of spelling disability. The second article will present the evidence concerning factors which, although related, are probably not causal in spelling disability.

wherever possible practical implications are formulated for the spelling diagnostician.

Because of the communality of the language functions, some of the evidence concerning reading difficulties is pertinent to a discussion of spelling disability. In those areas in which spelling research is scanty or conflicting, the writer has used the data from the analogous field of reading. The necessity for a summary is evidenced in the lack of unity of knowledge or opinion among those writing on the subject of spelling. For example, as causes or important factors in spelling failure:

Kallom gives "visualization and hearing, pronunciation, effect of vowels and consonants, doubling, silent letters, length of words" (72)
Schonell lists "memory, phonetic analysis, auditory discrimination and recognition" (119)
Baird declares "motor imagery most important factor" (6)
Foran names "speech, vision, hearing and defective mental imagery" (38)
Hollingworth lists "sensory defects, pronunciation, intelligence, visual perception, memory span of various kinds, vocabulary, motor coordination, lapses, bilingual background, idiosyncrasies of error, school history" (68)

I. *Physical Factors*

A. Vision. In an unpublished study (124), the writer has summarized the recent research on the relation between various visual defects and spelling and reading disabilities. Briefly, the indications are:

1. Visual defects may or may not distinguish between groups of good and poor spellers according to the vagaries of sampling.
2. However, defects are undoubtedly a hindrance in many individual cases and their correction as great an advantage.
3. Such defects as hyperopia and muscular imbalance, particularly exophoria and strabismus, are frequently associated with less than normal progress in spelling and reading.
4. Such defects as myopia, astigmatism and losses in visual acuity are not necessarily associated with less than normal progress, although they may be when the defect is of a gross nature.
5. Although the evidence is not complete, such handicaps as aniseikonia, limitations in the visual field, loss of binocular coordination and stereopsis appear to be related to spelling and reading failure.
6. The rate of maturation of certain ocular characteristics, as interpupillary distance, may bear upon the genesis of spelling and reading disabilities.

B. Auditory Acuity. Although recognizing the lack of uniform standards as to what constitutes defective hearing, and the lack of uniformity of methods of testing, Terman and Almack (130) conclude that probably 10–20 percent of school children do not hear normally and that the hearing of 2–3 percent is seriously impaired. They further conclude that serious defects of hearing are definitely related to school retardation. The studies they cite support the fact that there is greater incidence of defective hearing among average children than among the bright and more among the dull than among either average or bright.

Two studies have contrasted the auditory acuity of good and poor spellers. Gates and Chase (50) indicate that groups of deaf children are not necessarily inferior in spelling. This evidence does not demonstrate that unrecognized losses are of no significance but merely that gross losses are often met by compensation. Russell (117) found no real differences between good and poor spellers in percent of hearing losses of the better ear. Nor were the spelling errors of 13 children with distinct losses reliably different from those of their matched pairs or the total normal group. The writer has demonstrated (123) that Russell's method of comparison is not likely to reveal differences. Adding all the errors of all the group together and expressing this sum as a percent of their total errors conceals rather than reveals the characteristics of the group.

More significance is found in the study of individual cases of spelling disability. Of 31 cases, four were attributed to defective hearing by Wells (141). Of 26 cases, one was due to defective hearing, according to Floyd (37). In the analogous field of reading, Bond (14), Monroe (97) and Gates (44) describe cases which they attributed to defective hearing However, Madden (91) discovered no real differences between normals and hard-of-hearing children in the tests of the Stanford Achievement battery. Support for the conclusion that auditory acuity is important in spelling ability must be drawn from the case studies rather than the studies of groups.

C. Auditory Discrimination. Russell's group of spellers was reliably inferior in auditory discrimination, as measured by the common test of distinguishing between pairs of words of similar sound (117). In the field of reading, Bond (14), Monroe (97) and Cutright and Anderson (22) report poor readers poor in auditory discrimination. Ten of Hinck's 14 cases of extreme reading disability were below average on Seashore's test of sense of pitch (65).

In an earlier article (123), the writer has demonstrated that there is 1) a definite tendency for poor spellers to make a greater number and percent of non-phonetic errors, 2) that poor spellers exceed in such errors as non-phonetic substitution, omission of sounded letters and of syllables and 3) poor spellers make fewer errors in phonetic additions and phonetic substitutions. The errors in which poor spellers exceed are due, at least in part, to lack of accurate auditory discrimination.

There is sufficient evidence to conclude that auditory discrimination plays a causal part in spelling disabilities. The evidence is confirmed by the characteristic errors of poor spellers.

D. Motor Coordination. Poor motor coordination is indirectly related to spelling success in several ways, specifically through its influence upon handwriting and speech. The importance of these specific skills will be discussed at greater length later in this article. At this point the evidence concerning general motor coordination is more pertinent.

Baker (7) states that the median score of good spellers, as measured by final marks, was distinctly above that of the entire group of 60 subjects on the Whipple–Healy Tapping Test. Similarly, the median score of poor spellers, as measured by the Stanford Achievement spelling test, was inferior. Gates (44) and Bronner (16) describe cases that evidenced inferior motor control which displayed itself in poor writing, halting articulation with stammer and general clumsiness of hand. Lack of motor coordination also makes itself evident in the irregular and regressive eye-movements characteristic of poor spellers and readers.

Considering it as a unitary trait, for the moment, the evidence clearly indicates that motor coordination is significantly related to spelling success.

E. Handwriting. It is generally accepted that poor handwriting is causally related to spelling failure. This must be conceded if for no other reason than the common practice among teachers of considering illegible or badly written spelling words as misspelled. The general opinion is evidenced also by the fact that the majority of the writers attempting classification of spelling errors, as reviewed in an earlier article (125), used handwriting as a category of spelling errors.

For convenience the experimental evidence may be divided into the topics of speed and quality of handwriting. Acomb (2) reports a correlation of + .58 between spelling and speed of handwriting in grades III–VI. Although he believed it an important factor, Potter's results (114) did not

show speed of handwriting to be correlated closely with spelling ability. Cobb, et al. (20) did not find good and poor spellers materially different in speed of written reproduction.

In quality of handwriting Russell's poor spellers were poorer, on the average, by a year according to the Thorndike Handwriting Scale. But Gates (44) found an r of only + .18 between quality of handwriting and spelling in III–VIII. Among case studies, one finds Floyd (37), Gates (44) and Baker (7) attributing disabilities to inferior or slow writing.

One would not expect to find high statistical relationships between speed or quality of handwriting and spelling ability because of the many mutually exclusive factors influencing success in the two fields. Generally speaking then, the relation between handwriting and spelling is only moderate. However, many individual instances are available in which illegibilities, poor letter formation, letter eccentricities, etc. contribute to a large extent to spelling failure. The number of these instances is sufficient in some samples to raise the general relationship to a significant level.

F. Speech and Pronunciation. Defective speech is accepted by many as a causal factor in spelling disability. A specific instance of such a relationship is described in detail by Book (15). The subject was a boy suffering from a speech defect with consequent misspelling since he attempted to spell phonetically. Other cases are described by Gates (44), Floyd (37) and Schonell (121). In her classification of spelling errors, derived from a questionnaire of teachers, Davis (25) recognized the influence of speech defects. Of Murray's poor spellers (101), a number attributed their difficulties to defective articulation.

Russell (117) indicates that the poor spellers made a reliably greater total number of speech errors and were poorer in rhythm of oral reading. These conclusions might have been deduced from the fact that the poor spellers were also inferior silent readers. Speech characteristics of good and poor readers have been compared by Monroe (97) who found many more speech defects among the reading-defect cases and Bond (14) who reports no real differences. The present writer has computed from Moss' data (100) that the differences between speech-defective and normal second grade children in rate and number of errors on the Gray's Oral Reading test, although large, are not reliable. Using the questionable technique of asking the children whether they had ever stammered or stuttered, Bennett (8) found no real differences between good and poor readers. Questioning the parents re-

vealed a significantly greater incidence of history of some speech defect among the poor readers. The conflicting results of these writers may readily be explained by the lack of comparability of their methods. As Russell (117) discovered, even though using the same method, trained observers will differ considerably in the number and type of errors they attribute to a subject. In the key words of a more carefully standardized test such as the Sherman Articulation Test, Russell did not find real differences between good and poor spellers.

In the particular speech error known as mispronunciation, supplementary data are available. Using the Gates Word Pronunciation Test, a test complicated by the fact that the pupil reads the words aloud, Russell (117) claimed to find a very large difference in favor of the good spellers. For the same test Gates (44) gives r's of + .62 with Grays' Oral and + .70 with silent reading tests. Elsewhere Gates (48) gives r's of + .81 with reading short words, + .54 with comprehension in reading, + .84 with oral reading and + .79 with reading comprehension for this test. Russell's results are therefore invalidated, since the test is apparently not one of pronunciation but rather one of sight vocabulary or reading. Hence the difference in the so-called pronunciation test may readily be a difference in reading ability, for the poor spellers were inferior silent and oral readers.

Clearer facts are offered by Hartmann (61) who notes an r of + .58 between spelling ability and the pronunciation section of the Cross English Test. The difference between the mean scores of the poor and average spellers was reliable while that between the mean scores of the good and average spellers was not. Although this test was read aloud, the groups were equal in oral reading ability.

Miss Marjorie Kay (73) conducted an experiment to determine the influence of errors in pronunciation upon spelling. She tested the pronunciation of certain spelling words by inserting them in stories to be read aloud and the spelling of the words by writing the story at dictation. Following the teaching of the pronunciation of any mispronounced words, spelling and pronunciation were again tested. A fifth grade evidenced an 8 percent decrease in misspellings while a fourth grade gained 17 percent. The general recognition of mispronunciation as a cause of spelling errors is evidenced by the inclusion of such a category in their systems for classifying spelling errors by eleven of the writers mentioned in a preceding article (125).

The influence of bilingualism and colloquial pronunciation upon spelling success has been established by several writers. By comparing the spelling scores of children from English and foreign-speaking homes, Reed (115) discovered that the influence of the language spoken in the home was to reduce the pupils' ability to spell, on the average, about three percent. This influence decreased with advancement through the grades.

Anderson and Kelly's (4) readers were not differentiated by the use of a foreign language in the home. In fact, more of the fathers of the controls were foreign-born than those of the reading-disability group. Bennett (8) has pointed out that this might have been expected since more of the poor readers were referred for school problems. Hence it was probable that they came from homes where language difficulties were more readily recognized and treatment sought, i.e. English-speaking homes. But Bennett's own data (8) reveal a similar tendency. Ladd (77) reports a positive but unreliable correlation between inferior reading achievement and the extent of foreign language spoken in the home. In the larger surveys of Gray (57), O'Hern (103) and Kirkpatrick (76) the reading achievement of children from foreign-speaking homes was lower than that of children from English-speaking homes.

Of 31 cases of spelling disability, five are attributed largely to lack of familiarity with English by Wells (141). Floyd (37) similarly characterizes one of her cases. Mispronunciation was the most frequent difficulty of foreign children in interpreting words according to the reports of 19 teachers, as summarized by Frances Dearborn (26). Although they have not introduced any experimental data, misspellings are attributed to foreign or colloquial pronunciation and bilingualism by Williamson (143) who believes that there is a transfer of interfering habits from the other language, and Speer (126) who uses such a category in her system of classifying spelling errors. Both Gates (44) and Hollingworth (67) recognized that early training in a foreign language may be an important factor in backwardness in spelling.

It may be noted that, if for no other reason than the tendency to spell phonetically, and hence to misspell mispronounced words, attention must be given to the pronunciation, bilingualism and articulatory defects of children if one is to understand their spelling difficulties. Such characteristics may not differentiate matched groups of spellers or readers but they apparently do possess a positive relationship to many cases of disability.

II. Intellectual and Temperamental Factors

A. Intelligence. Mental ability is universally recognized as a potent factor in the genesis of poor spelling. Some even claim it to be the most important determinant of spelling ability. For example, Gates states, "Among unselected children, backwardness in reading and spelling will probably be more frequently associated with low general mental ability than with any other single cause". (44) Some idea of the significance of intelligence in reading may be gathered from the data assembled by Louttit (85). He lists 46 correlations between intelligence and reading. The median for the entire group is + .60, the mean + .55. The median for 11 coefficients based on group tests of intelligence is + .75, the median for the Stanford–Binet and reading is + .56.

The writer has compiled a similar table to demonstrate the relationship between intelligence and spelling. In all, 57 correlations have been found. The median for the entire group is + .44, the mean + .456. The median for 25 r's based on group tests of intelligence is + .44, for individual tests, + .441. For 29 r's based on single grade ranges, the median is + .518; for several grade ranges the median is + .408. There is some tendency for the relationship to decrease with advancement in the grades for the median for 19 r's for grades I–V is + .56. For 15 r's for grades above the Vth the median is + .50.

The present data imply that a correlation of approximately + .45 represents the average relationship between spelling and intelligence. Of course this correlation may be artificially high since chronological age has not been held constant. Garrison and Garrison (42) concluded that an r of + .55 might be considered typical. Their conclusion was based on 31 correlations between the Ayres Spelling Scale and the Stanford–Binet which had a median of + .57 and amean of + .58. Louttit (85) considers a correlation of approximately + .50 as typical of those between mental ability and spelling.

In view of the significant relationship between spelling and mental ability, some might think it surprising that groups of poor spellers are not lower in median intelligence than large samples from the general population. Russell's groups had mean intelligence quotients of 102.56 and 101.52 respectively. (117) Floyd's cases (37) ranged from 69 to 134 in I.Q., the median for 22 of the cases being 95. Davis' cases (25) ranged from 70 to

above 110 with a median of 86. Gates' backward readers and spellers (44) had a median Binet I.Q. of 116. McGovney's poor spellers (90) ranged from 111 to 126. Despite the importance of intelligence, groups of poor spellers are not necessarily handicapped in this respect.

These facts indicate that spelling disability may exist among dull, normal and superior children. They also demonstrate the necessity for the diagnostician to look for other factors that may, in certain cases, possess greater significance. It is almost unnecessary to note that the relation between spelling and mental ability indicates the need for attempting to determine the exact significance of the latter in each case of spelling disability.

As in determining the intellectual level of reading disability cases, care must be exercised that the difficulties of the child who is handicapped in spelling are not allowed to influence the score on a mental test. All too frequently disabled spellers experience only slightly less difficulty in other

TABLE I

CORRELATIONS BETWEEN SPELLING AND INTELLIGENCE

A. Single Grade Range

Author	N	Grade	r	Variables
Garrison & Garrison (42)	67	II	+.73	Binet M. A.—Ayres, average of two r's.
	124	III	.68	" " " " four r's.
	127	IV	.62	" " " " " "
	192	V	.64	" " " " six r's.
	164	VI	.58	" " " " five r's.
	131	VII	.52	" " " " four r's.
	170	VIII	.43	" " " " five r's.
	54	IX	.39	" " "
	124	III	.62	National—Ayres
	127	IV	.64	" "
	192	V	.51	" "
	164	VI	.47	" "
	124	II	.56	Otis Primary—Ayres
	127	III	.56	" " "
	192	V	.49	Otis Advanced—Ayres
	164	VI	.40	" " "
Gates (46)	c20	III	.56	Composite intelligence and spelling tests.
Guiler (59)	21	V	.20	Otis Advanced I. Q. —Ayres
			.24	" " M.A. — "
	21	V	.28	" " I. Q. —Jones List
			.35	" " M.A. — " "
Houser (70)	44	IV	.71	Composite Binet-Teachers' estimate with own spelling test
	36	V	.596	" "
	39	VI	.346	" "
	35	VII	.492	" "
	32	VIII	.508	" "
Omwake (105)	34	VIII	.602	Illinois M.A.—Ayres
Watson (140)	117	IX	.23	Terman Group Score—Composite spelling
Williamson (143)	53	XIII	.72	Minnesota College Aptitude—own spelling test

B. Several Grade Range

Author	N	Grade	r	Variables
Acomb (2)	380	III-VI	+.80	Binet M.A. —own spelling test
			.41	" I.Q. — " " "
Bird (12)	60	IV-VIII	.29	Composite mental —Ayres in columns
			.26	" " " — " in sentences
Burt (17)	300	7-14 yrs.	.52	Binet —own spelling test
Gates (45)	75	I-II	.35	" M.A.—own spelling test
	90	III-IV	.46	" " " " "
	144	V-VII	.41	" " " " "
Gates (44)	135	III-VIII	.42	Composite group—own spelling, average of 6 r's.
	91	III-VI	.31	Binet M.A.—own spelling, average of 4 r's.
	135	III-VIII	.15	Composite non-verbal—own spelling, ave. of 6 r's.
Gates and LaSalle (51)	75	III-VI	.85	National—Ayres
	75	III-VI	.60	Binet M.A.—Ayres
	75	III-VI	.62	" " "
Hollingworth (67)	13	9-12 yrs.	.24	Binet I. Q.—Ayres
	14	8-13 yrs.	.08	" " "
	9	9-13 yrs.	.42	" " "
	23	8-13 yrs.	.12	" " "
Hollingworth (68)	30	?	.08	" M.A. —own test
	30	?	.23	" " " "
	30	?	.16	" I. Q. " "
	30	?	.31	" " " "
Kiefer and Sangren (74)	?	College	.54	Army Alpha—own test
Murray (101)	74	"	.59	Composite reasoning—own test
Omwake (105)	150	"	.173	Army Alpha—Ayres
	450	V-VII	.448	National I. Q.—Ayres
Porteus (113)	32		.78	Feebleminded boys; Binet and his educational attainment scale
	26		.68	Feebleminded girls: " " " "

language functions. Durrell (30) has demonstrated that the I.Q.'s of children experiencing reading difficulties are distinctly lower when measured by such a test as the Stanford–Binet. If the I.Q.'s are depressed by the few items dependent upon reading in the Binet, they must certainly be greatly influenced by the usual group test. Tests such as the National, Illinois, Otis Self-Administering, Terman Group, Kuhlmann–Anderson, etc. cannot yield adequate measures of children experiencing spelling difficulties, however satisfactory they may be in other respects.

B. Attitudes, Interests and Emotions. If one may judge by the statement of Olson, the study of the attitudes and interests of children has proved a particularly fruitful area of investigation. He says, "Most efforts to rate or test social behavior, information, attitudes and interests result in scores that give a unique contribution to the prediction of achievement in school subjects . . . " (104).

It is probably true as Betts says, "The biggest obstacle to overcome in any remedial teaching is the system of undesirable attitudes acquired by the

learner" (9). Such interfering attitudes as lack of interest and application and carelessness are commonly attributed to poor readers and spellers. Both Wells (141) and Floyd (37) describe cases attributed largely to these unfortunate attitudes. Gates (43) claims that 82 percent of his poor readers manifested unfavorable attitudes. Gray (56) considers lack of interest as a possible cause of poor reading. A number of Parr's (110) adult poor readers attributed their difficulty to lack of interest and lack of voluntary reading. Russell (117) reports a significantly greater number of good spellers rated "good" in attitude by the examiner. Collectively, these opinions and facts support the implications of Olson and Betts that attitudes are important determinants of success and that they warrant the attention of the diagnostician.

After intensive review of the literature on the relationship of interests and abilities, Fryer (41) concluded that the interest expressions of the individual, as measured by questionnaires, etc., are not indicative of educational ability to a high degree. He considers an r of approximately + .30 as representing the average relationship. Despite the discouraging outlook, several studies of reading and play interests may be cited. Lehman and Witty (81) found leisure reading the most common play activity of children. Lundberg, et al. (87) also report reading as an outstanding interest of children. Both Terman (129) and Lehman and Witty (81) report that gifted or accelerated children read more than the average. Conversely, McCallister (89), Parr (110) and Bennett (8) found little voluntary reading among poor readers. These data support the conclusion that good and poor readers differ distinctly in the interest they evidence in reading. Even more positive evidence is offered by Lipscomb (82) who noted that the number of books read and Ladd (77) who found that the time spent in voluntary reading and the number of books owned by the child were related to reading age.

Differences also exist in some aspects of play interests, although the evidence is not in perfect accord. Lehman and Witty (81) report that retarded children manifested a greater tendency to seek active, more vigorous forms of play and social activities. Bennett (8) noted a slight tendency for his poor readers to seek more sedentary play and to spend more time at home. These findings are not necessarily contradictory since Lehman and Witty's retarded children were probably of limited mentality while Bennett's were normal. On the basis of the numbers concerned, the statistical signifi-

cance of the results and the extent to which the findings follow the expected mechanism for compensation, Lehman and Witty's results are probably the more dependable. Bennett's group was somewhat neurotic in that they manifested feelings of inferiority, inadequacy and insecurity. This may explain their tendency to withdrawal.

Specific play interests or associates and desire for adult companionship do not appear to differentiate good and poor readers, according to Bennett (8) and Ladd (77). To summarize, the studies of interests seem to indicate the expected patterns of less interest in voluntary reading and more in vigorous play among children handicapped in language functions.

Evidence specifically concerned with the relation of emotions and spelling ability is given in the case studies of Travis (136) and Ulrich (137). Both describe children who misspelled words because of emotional connotations. Even though one may not be an adherent of Freudianism, these interpretations are reasonable. We have already been led to conclude that the general attitudes of the learner are closley related to success. It is but a small step to recognize the importance of emotionally toned attitudes. That emotionally toned connotations of words may not influence their spelling in all instances is evidenced in the data of Frandsen (39). He found an r of only $+.109 \pm .06$ between the ability to spell and the degree of pleasantness of connotations of words. The influence of emotional tone is probably highly specific with respect to both words and individuals.

III. Subject Matter Achievement

A. Phonetic Skills and Knowledges. Russell (171) reports that his poor spellers were reliably inferior in such phonetic skills as giving letters for letter sounds, blending letters to form syllables and words, and spelling one- and two-syllable nonsense words. The present writer cannot share Russell's acceptance of the latter tests as diagnostic instruments. They appear to be merely novel variations of the test of giving letters for letter sounds. McGovney (90) found poor spellers distinctly inferior in giving sounds for letters and sounds for two syllables. Baker (7) states that the median score of his poor spellers who experienced difficulty with phonics was below that of the entire group in his tests of Free Association, Opposites, Auditory Rote Memory and Orientation. In an earlier article (123), the writer reported the tendency among poor spellers to make non-phonetic errors such as non-phonetic substitution, omission of sounded letters and of syllables. They

made fewer errors of phonetic additions and substitutions. These errors may be due, at least in part, to inadequate phonetic knowledge and skill.

In the analogous field of reading, Monroe (97), Bond (14), Warnke (139) and Hincks (65) have noted the definite inferiority of poor readers in phonetic knowledge and skills. Baker (7) reports that his poor readers who experienced difficulty with phonics were inferior in his tests of Free Association, Opposites, the Binet Vocabulary and Auditory and Visual Rote Memory.

There is ample evidence to conclude that phonetic knowledges and skills play an important part in spelling ability. Still further evidence will be introduced in the section on Methods of Study in the successive article when it will be shown that poor spellers are characterized by a lack of analytic ability in attacking new words. The present evidence is confirmed by the characteristic errors of poor spellers.

B. Vocabulary. For some time the writer has felt that the significance of the child's vocabulary as a determinant of spelling success has not been sufficiently recognized. It has been his impression that this knowledge should be given equally as much weight as the factor of intelligence in attempting to understand the child's spelling difficulties. Among those who have recognized the importance of this ability to understand, define and use words is Hollingworth (67), who claims that 66 2/3rds percent more misspellings occur in words in which the meanings are unknown or uncertain. Reed's experiments (115) in teaching spelling with and without meanings indicate that the class taught both meanings and spelling gained more and retained more than the class taught spelling alone. Almack and Staffelbach (3) found that when both meaning and spelling were known, misspellings decreased spontaneously about two percent.

Baker (7) reports that the median score of good spellers, as measured by final marks, was above that of the entire group on his tests of Free Association and Opposites. Good spellers, as measured by the Stanford Achievement test, were superior on his test of Free Association and the Binet Vocabulary. Poor spellers were distinctly inferior on his tests of Opposites and the Binet Vocabulary. Cobb, et al. (20) discovered that good spellers were superior in a test of building words from a given word. Monroe (98) noted that reading defect was accompanied by poor vocabulary or by difficulty in combining language symbols into meaningful relations in many cases.

Statistical evidence of the correlation between spelling ability and vocabulary may be gathered from Table II.

The median of these 31 coefficients is + .612, the mean + .589. The median for 15 coefficients based on single grade range is + .633; for several grade ranges, + .575. There is some tendency for the coefficients to decrease with grade, i.e., the median for the 19 r's of grades II–V is + .628; for the 8 r's of VI and above, the median is + .50.

It may be concluded that a coefficient of approximately + .60 is typical of the association between vocabulary and spelling. A coefficient of this magnitude is usually considered to indicate a marked relationship. Of course, the relationship may be dilated by the common element of the influence of

TABLE II

CORRELATIONS BETWEEN SPELLING AND VOCABULARY

Author	N	Grade	r	Variables
Acomb (2)	380	III-VI	.74	Own spelling and auditory vocabulary tests
Gates (44)	c30	III-IV	.38	Written spelling—Gates Word Pronunciation
			.48	Oral spelling— " " "
	c30	III	.49	Own spelling —Binet vocabulary
		IV	.39	" " " "
	c30	III	.60	" " —Composite visual vocabulary test
		IV	.37	" " — " " " "
	40	VII-VIII	.47	" " — " " " "
	c30	III	.57	" " —Holley's Visual Vocabulary
		IV	.40	" " " " "
	40	VII-VIII	.45	" " " " " "
Gates (48)	85	III-IV	.74	" " —Gates Word Pronunciation
	50	I	.70	" " " " "
Hollingworth (67)	c30	V	.55	" " —ability to use words
Houser (70)	44	IV	.64	" " —ability to define same words
	36	V	.61	" " " " " " "
	39	VI	.81	" " " " " " "
	35	VII	.45	" " " " " " "
	32	VIII	.61	" " " " " " "
Merrill (94)	59	M.A. 8	.659	Stanford Achievement Spelling and Vocabulary tests
	86	M.A. 9	.715	" " " " " "
	76	M.A. 10	.786	" " " " " "
Spache*	181	II	.63	Metropolitan Ach. Primary II, " " " "
	105	II	.64	Progressive Ach. Primary, Spelling—Vocabulary Average
	234	III-V	.65	Metropolitan Ach. Inter., Spelling and Vocabulary tests
	185	IV-V	.57	Progressive Ach. Elem., Spelling—Vocabulary Average
	364	IV-VI	.71	New Stanford Ach. Spelling and Vocabulary tests
	186	VI-VII	.50	Progressive Ach. Inter., Spelling—Vocabulary Average
	363	VI-VIII	.30	Metropolitan Ach. Adv., Spelling and Vocabulary tests
Terman (129)	100	III-VIII	.54	Stanford Achievement Spelling and Vocabulary tests
Williamson (143)	53	XIII	.81	Own spelling and vocabulary tests

* These correlations are obtained from the testing in Friends Seminary and Brooklyn Friends School, New York City where the writer serves as school psychologist.

intelligence. As previously observed, the average r between spelling and intelligence was only + .45. These data strongly support the writer's contention that vocabulary knowledge is a more significant determinant of spelling success than intelligence, particularly in the first five grades.

IV. Miscellaneous

A. Home Background. In the discussion of Speech and Pronunciation, some evidence concerning the influence of a foreign language background upon spelling was introduced. The implication drawn was that bilingualism and foreign pronunciation appear to hinder spelling success. Socio-economic status or a measure of the material comforts of the home has been investigated for a possible association with spelling and reading difficulties. Ladd (77) reports a zero correlation between this factor and reading age, when mental age is held constant. Anderson and Kelly's (4) and Bennett's (8) data failed to differentiate good and poor readers in this characteristic or those of father's occupation and incidence of broken homes.

Bennett (8) reports no apparent relationship between the following and reading achievement: number of books in family library, schooling of parents, parental interest in reading, number, sex or reading achievement of siblings. According to Anderson and Kelly (4) "emotional tone" of the home was not a differential item.

Factors positively associated with reading achievement, according to preceding sections, were amount of leisure reading, number of books owned by the child and interest in vigorous types of play. Lack of reading materials contributed to their handicaps, according to a number of Parr's (110) adult poor readers.

Tinker (134) points out that Hinshelwood (66), Hollingworth (68) Hincks (65) and other have noted familial patterns of language difficulties. However, there has been no further investigation of the role of heredity as a causal agent in language disability, other than Monroe's report (97) that a greater incidence of left-handedness was present among the relations of the reading defect cases.

Apparently such elements as gross socio-economic status, broken homes, father's occupation, etc. do not bear a marked association to spelling or reading success. This does not permit the diagnostician to ignore these and similar elements of home background. Elements of the intra-family relationships which have been shown to have a definite influence upon the out-

comes of treatment of problems of behavior and school failure are: harmony of the home, marital adjustment, behavior of parents toward children and lack of cooperation in parents or children. Factors definitely associated with unsuccessful treatment are ambivalence, rejection or dislike of parents for child. (144)

Despite the fact that certain elements may not statistically distinguish disabled children from their classmates, a careful diagnosis will include a detailed study of the home background. As essentials of this study, Gray (56) suggests kind and location of home, educational status of parents, their ability and interest in reading, their attitude toward school, books and magazines in the home, the child's employment, the control or discipline of the home, the child's favorite play activities, the age and characteristics of siblings and the amount and nature of leisure reading.

B. Early Training. Inevitably in the study of a case of spelling disability, the question of the adequacy of the instruction and teaching techniques in the child's earlier training arises. In a field such as spelling, in which many techniques are still unverified, it is usually quite possible to find fault with the efforts of one's predecessors. However, there is some more or less impartial evidence demonstrating the role of defective early training as a causal factor in spelling disability.

Gates (44) attributed the spelling failure of a number of cases to inappropriate or faulty teaching. Overemphasis upon oral spelling at the expense of written and overemphasis upon the phonetic approach to words were methodological causes of failure in his opinion. Still other cases were blamed upon the lack of training in methods of word-attack. The discussion in preceding sections has demonstrated the necessity for attention to methodological factors. For example, it has been shown that the child's vocabulary bears a marked relationship to his spelling success. Therefore, inadequate vocabulary training and ignoring the necessity of teaching the meanings of all spelling words will strongly contribute to some cases of spelling failure.

Foran's (38) summary of methods of presentation of spelling words has shown that one method is not satisfactory for all children. It is not difficult to recognize that a teacher's constant use of a single method is not only inefficient insofar as the child's mastery is concerned, but actually detrimental to those who would learn better by another type of presentation. Thus early training may be defective or inadequate merely by reason of the

failure to recognize and make provision for individual differences or to adapt instructional techniques to the needs and deficiencies of the group.

It may be concluded that the diagnostician should attempt to ascertain the nature of the methods employed in the preceding grades as well as the character and amount of any tutoring or remedial work.

C. Educational History. Most students recommend a study of the educational background of children suffering from spelling disability. It is well to review the experimental findings to determine which facts are likely to prove fruitful in such investigation. Theisen (131) reports an r of + .008, and Monroe one of + .22 between attendance and reading achievement for first-grade children. Terman (129) found an r of + .041 between spelling achievement quotient and attendance for 109 gifted children who had attended school for 2–6½ years. There was no real difference between good and poor readers in average number of days absent per semester in Bennett's groups (8). These data merely indicate that for the central mass of children the average amount of absence is not a hindrance to success. They do not disprove that some children may fail because of excessive absence. As Theisen (131) points out, absences as great as two months seem to have significance.

Among those who are of the opinion that long absences or frequent school changes are sometimes responsible for disability are McCallister (89) and Parr (110). Unfortunately, all of those cited above neglected to compare the extent of absence in their groups with the average for the populations they sampled. It was not established that either the disabled or control groups were similar to the general population. It may be possible that both groups suffered from excessive absence. Hence, the disabled would not have appeared to have had greater absence than the controls, even though they were absent a much greater amount than the average child. Perhaps more reliable evidence may be gathered from the studies of individuals. Gates (44) describes one case whose reading difficulty dated from a four-month absence in the second grade. Among the present writer's remedial cases, one has been attributed to the causes of prolonged absence in the first grade and a resultant lack of confidence. Blanchard (13) attributed the difficulties of a case to frequent school change in the early years. It may be concluded that, in some instances at least, change of school or absence greatly in excess of the general average contributes markedly to spelling or reading failure.

Anderson and Kelly (4) found no material differences between reading-defect cases and their controls in amount of training, age at entering school or number of school changes. Bennett (8) reports no real relation between reading and the following: semesters in kindergarten, skipping, number of school transfers, age of learning to read, liking for teacher and cooperativeness of teacher or parent as judged by the other. The evidence of these writers would be improved if they had clearly established the normalcy of their samples.

Several genetic factors appeared in the educational histories of poor readers to a greater extent according to Bennett (8). There was much more frequent mention of early difficulties in learning to read and many more difficulties in other curricular fields. Bennett summarizes these as follows: Poor readers were reported to have 10.1 times as many past reading difficulties, 3.7 times as many present difficulties in other subjects, 3.2 times as many past deficiences in other subjects. It is apparent that educational disabilities in a specific field do not arise suddenly but rather that they are preceded by symptoms of their coming. The communality of language functions and disabilities, that we have presumed throughout this article, is evidenced by the frequency of difficulty in allied fields among disabled readers and spellers.

In the second of these two articles, there will be a critical review of the evidence concerning factors which, although related, are probably not significant or causal in spelling difficulties.

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A STUDY OF RACE AND SEX DIFFERENCES IN READING COMPREHENSION

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Editor's note: A number of studies have been conducted of race and sex differences. The study here reported is particularly interesting in that it shows what may be accomplished through remedial instruction.

THIS study is one such as is commonly undertaken by supervisory or research workers at the request of school administrators. The investigation has to do with the existence or the absence of sex and race differences in reading comprehension among Anglo-American and Spanish-American pupils in the upper elementary grades of the El Paso Public Schools. Specifically, the problem might be stated as follows: Is there enough difference in reading comprehension as measured by a standardized test among boys and girls and also among Anglo-American and Spanish-American pupils in the upper elementary grades to justify separating either the sex groups or the racial groups for purposes of instruction, or to justify the development of different curricula and the use of different teaching methods, or to justify judging the results of reading teaching by different standards? This is a problem of some concern to administrators, supervisors, and classroom teachers alike, since the answer or answers obtained by research affect directly the work of the school and the learning opportunities of pupils.

The test used in this study was the El Paso Silent Reading Test.[2] Form I of this instrument was used in September, 1938; Form II, in May, 1939. The tests were given in grades five to eight inclusive, although not all classes were tested in either instance. A total of 9,276 pupil responses to the test have been used in the study. The grade designations are those of September, 1938, but the combination of grade levels were made to place together for the purposes of this study all pupils of similar reading training. Thus, pupils in grade H5 in May, 1939, had only about two weeks less reading training at the time they responded to the test, than had pupils in grade L6 in September, 1938, at the time they responded to the test.

The two forms of the test are equivalent in difficulty. Each form of the instrument includes several types of content, and each measures a variety

[2] The standardization of this instrument has been described in M. E. Broom, Anna McGurn, and Margaret Trachsel. "A Silent Reading Test for Upper Elementary Grades," *El Paso Schools Standard*, XV (October, 1937), pp. 9–15.

of reading skills: the knowledge of word meanings; comprehension of total paragraph meaning, of central thought, and of specific factual information; the ability to read and comprehend and to follow precise directions; and the ability to organize materials read and comprehended. Speed during reading is measured indirectly only. Each form of the test has one hundred scorable items. The validity of the test is high. Against criteria, scores yielded by three highly regarded silent reading tests, the validity coefficients varied from positive .697 to positive .880, with a median value of positive .836. The coefficient of reliability of the test is positive .913 $\pm$ .010. The ratio of the probable error of measurement to the mean is .061; to the standard deviation, .199. These measures indicate that the reliability of the instrument is comparatively high.[3] Grade norms and grade placement norms are available for the test.[4]

The 9,276 pupils' responses to the test were scored, and the scores were classified and tabulated, prior to statistical analysis. All computations were calculated and checked, using machines and tables to insure accuracy. The findings were assembled into tables. Tables I and II present the information with regard to sex differences, without regard to race.

The data in Table I indicate the presence of overlapping achievement in these eight half grades, evidenced by the values for the range. The differences between the medians and their corresponding means generally are small in value. The standard deviations also are quite similar, with variability approximately uniform among the sixteen groups of achievement records. The averages show that girls have an advantage over boys in general, since in every instance the median and the mean values are larger for girls than for boys in the same grade. Table II presents experimental coefficients indicating the significance of the score differences that are summarized in Table I.

The evidence in Table II does not indicate the existence of a statistically significant difference in reading comprehension between boys and girls, although girls are favored over boys in the eight half-grade groups. Three of the eight experimental coefficients are above 1.0 in value, indicating that in three of the eight grade levels the difference is one that is not due to chance or random sampling. The median EC value, .93, indicates that in

[3] Broom, M. E. *et al, ibid*, page 15.

[4] Broom, M. E. "New Norms for the El Paso Silent Reading Test," *El Paso Schools Standard*, XVII (September, 1939), pp. 20–21.

TABLE I

SUMMARY OF READING COMPREHENSION SCORE DATA ACCORDING TO SEX AND SCHOOL GRADE. N = 9,276

Grade	Group	N	Range		Md	M	σ
			From	To			
H8	Boys	254	37	97	67.2	67.7	16.5
	Girls	290	33	98	68.5	69.3	15.3
L8	Boys	654	23	97	66.6	66.4	15.2
	Girls	602	28	97	67.7	67.6	15.3
H7	Boys	742	24	97	57.8	58.8	14.6
	Girls	681	16	97	60.4	61.3	15.1
L7	Boys	813	10	94	50.4	51.6	15.7
	Girls	726	13	93	51.5	52.7	14.8
H6	Boys	825	8	91	41.5	43.4	15.8
	Girls	805	6	92	44.4	45.4	15.2
L6	Boys	820	9	90	37.5	38.8	15.1
	Girls	736	3	87	40.3	41.8	15.2
H5	Boys	553	0	78	33.9	35.0	13.5
	Girls	521	8	87	37.1	38.7	14.5
L5	Boys	122	1	69	33.4	33.4	14.0
	Girls	132	12	79	37.8	37.7	12.3

TABLE II

CRITICAL RATIOS INDICATING THE SIGNIFICANCE OF DIFFERENCES IN READING COMPREHENSION AMONG BOYS AND GIRLS

Grade	Groups	EC
H8	Boys versus Girls	.42
L8	Boys versus Girls	.50
H7	Boys versus Girls	1.14
L7	Boys versus Girls	.51
H6	Boys versus Girls	.93
L6	Boys versus Girls	1.40
H5	Boys versus Girls	1.55
L5	Boys versus Girls	.93

general the critical ratios do not indicate a statistically significant difference in favor of girls over boys.

Table III and Table IV present information about race differences in a manner similar to the treatment of sex differences in Tables I and II. The summary measures describing the race group achievements appear in Table III.

TABLE III

SUMMARY OF READING COMPREHENSION SCORE DATA ACCORDING TO RACE AND SCHOOL GRADE. N = 9,276

Grade	Group	N	Range		Md	M	σ
			From	To			
H8	Anglo-American	197	37	98	82.9	77.4	14.2
	Spanish-American	347	33	97	62.0	63.5	14.1
L8	Anglo-American	498	23	97	74.6	73.3	14.5
	Spanish-American	758	28	97	62.7	63.3	14.2
H7	Anglo-American	545	28	97	66.3	66.3	15.2
	Spanish-American	878	16	96	55.5	56.1	13.3
L7	Anglo-American	579	17	94	57.5	58.8	16.0
	Spanish-American	960	10	93	47.3	48.1	13.0
H6	Anglo-American	556	12	92	51.9	52.4	15.7
	Spanish-American	1074	6	90	39.1	40.3	13.8
L6	Anglo-American	572	17	90	45.5	47.0	16.1
	Spanish-American	984	8	80	35.6	36.3	13.2
H5	Anglo-American	545	0	87	43.0	41.2	14.6
	Spanish-American	529	4	77	31.4	32.2	12.3
L5	Anglo-American	227	1	79	36.4	36.0	13.2
	Spanish-American	27	11	59	32.0	32.6	13.6

The data in Table III show clearly that the Anglo-American students have a decided average advantage in reading comprehension over Spanish-American students in the same grade level. This is true in all grades. There is similarity in the range of achievement in the two race groups, particularly in the upper four grade groups. On the whole, reading comprehension achievement among the Anglo-American pupils is more heterogenous than among the Spanish-American pupils. The significance of the differences between the two race groups in each grade is analyzed by the experimental coefficients presented in Table IV.

The evidence in Table IV indicates the existence of a statistically significant difference in reading comprehension, a difference such as cannot occur due to random chance or sampling. In only one grade level, L5, is there found a result not in agreement with this statement, and reference to Table III will show that the Spanish-American students in this grade level numbered only 27 in all, too small a sampling to provide an adequate basis for the drawing of conclusions.

Test results reveal what a situation is; they do not reveal why the situation is as it is, nor by what processes the situation developed as it did

TABLE IV

CRITICAL RATIOS INDICATING THE SIGNIFICANCE OF DIFFERENCES IN READING COMPREHENSION AMONG ANGLO-AMERICAN AND SPANISH-AMERICAN PUPILS

Grade	Groups	EC
H8	Anglo-American versus Spanish-American pupils	3.97
L8	Anglo-American versus Spanish-American pupils	4.33
H7	Anglo-American versus Spanish-American pupils	4.64
L7	Anglo-American versus Spanish-American pupils	4.86
H6	Anglo-American versus Spanish-American pupils	5.50
L6	Anglo-American versus Spanish-American pupils	4.86
H5	Anglo-American versus Spanish-American pupils	3.95
L5	Anglo-American versus Spanish-American pupils	.44

develop. A statement drawn from a survey of reading achievement in the El Paso Public Schools in September, 1938, offers an explanation of the probable causes of the differences in reading achievement among Anglo-American and Spanish-American pupils. The statement is:

The schools predominately Spanish-American in pupil personnel show the effects of definite handicaps: part-time instruction in the past, more inexperienced teachers, and fewer facilities with which to work in the past, as well as the bi-lingual handicap. Reading achievement has improved in these schools materially during the past two years, however, and still greater improvement can be anticipated in the future, as the effects of certain of the handicaps affect smaller numbers of pupils. The entire effect will not disappear for several years to come, and only then if part-time instruction in the primary grades is discontinued entirely. The bi-lingual handicap probably never will disappear completely.[5]

When a problem situation exists, it is necessary that school administrators and supervisors do something to improve that situation. The administrative and supervisory staffs of the El Paso Public Schools have moved to improve the "teaching-learning" opportunities of Spanish-American pupils by reducing part-time instruction until it is now found in grade L1 only, except for two emergency situations that require temporary part-time instruction in primary grades. In addition, opportunities have been provided for in-service training of reading teachers, and books and school furniture of special types have been placed in all reading classrooms, making instruction and learning more efficient.

[5] Broom, M. E. "An Analysis of the Results Yielded by Reading Tests Given During September, 1938." Unpublished Research Study, El Paso Public Schools.

Such improvements as those mentioned in the preceding paragraph merely provide an opportunity for better teaching and learning. Maximum advantage of the opportunities can be taken only when there is a well planned and effectively operating teaching program, one that is flexible enough to permit changes to meet the needs of pupils. Such a program is never the product of the thinking and working of one individual or of a small group of persons; it is always one brought into being by the thought and the efforts of many persons.

The program of reading instruction in the El Paso Public Schools is essentially similar to what is commonly thought of as remedial reading. Reading instruction in the system reflects an attempt to bring together the best methods and materials available, and to present them to pupils in a way that will motivate pupils to improve their reading achievement. The attempt is to analyze in detail each pupil's abilities and disabilities, and to find a way to more efficient pupil reading through improved mechanics and improved ability to think accurately about what is read. This emphasis on improving skill does not entirely disregard pupils' interests, since an effort is made to provide different pupils with varied reading content of some interest to them individually, thus motivating improvement.[6]

The statistics presented in Tables I to IV inclusive indicate clearly the need for some change in the reading instruction of Spanish-American pupils, over and above the improved opportunities for all pupils heretofore described. It is not enough merely to make available improved classroom facilities for teaching and learning; different methods and better content need to be provided also. Before this can be done intelligently, some analysis other than that of mass statistics is needed. This analysis was made, using the error-analysis technique with 1,200 pupils' responses to the reading test, chosen at random from among those used in this study.[7] The results showed that word meaning deficiencies and inability to organize what has been read, together cause as many errors in comprehension as do all other variables

[6] The reading instruction program in the El Paso Public Schools has been described in

Broom, M. E. et al. *Methods and Materials in Reading for the Elementary Grades* (El Paso, Texas: The Public Schools, 1936), 91 pages.

Broom, M. E. "Fostering Individual Progress in Reading," *El Paso School Standard*, XVII (September, 1939), pp. 10–16.

[7] McNiel, G. B. "An Analysis of Errors in Silent Reading in Upper Elementary Grades." Unpublished Master's Thesis, Sul Ross State Teachers College, Alpine, Texas, 1939. 47 pages.

combined. Furthermore, the errors of Spanish-American pupils in these two phases of reading comprehension exceed the errors of Anglo-American by 15.2 per cent and 19.8 per cent, whereas the errors made by Spanish-American pupils on other aspects of reading comprehension exceed those made by Anglo-American pupils by from 3.4 per cent to 8.4 per cent, with a median of 6.9 per cent.

As a result of ascertaining these facts, it was decided to attempt improving vocabulary training, particularly through emphasis on phonics and on the explanation of word meanings during oral reading, as well as by specific drills in connection with materials read silently.[8] In addition, the supervisory staff of the El Paso Public Schools began the task of preparing specific instruction materials, devised to provide improved learning opportunities for pupils.[9] Certain of these materials are still in process of preparation, but the two major needs, a better knowledge of word meaning and a greater ability to comprehend and to organize what has been read, have been met. Particular emphasis is given to these two aspects of teaching reading in schools enrolling Spanish-American pupils.

The study described in this discussion was undertaken to ascertain the facts concerning sex and race groups in eight grade levels in the El Paso Public Schools. Sex differences were found to be not statistically significant, but a definite race achievement difference was found. A further investigation involving the error-analysis technique discovered the specific causes of this difference. Research, involving statistics, thus provided information of value to administrators and supervisors in their attempt to improve the teaching and learning opportunities in classrooms in which reading is taught.

The specific efforts made to accomplish this improvement, both through better facilities and through an improved reading instructional program have been described. Further investigations and analyses will be made from time to time to ascertain the degree to which the changes function in improving reading achievement in the school system.

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[8] In order to focus the teachers' attention on the teaching of word meanings, each teacher was given access to a copy of

Seegers, J. C. et al. "Vocabulary Problems in the Elementary School," *Seventh Annual Research Bulletin of the National Conference on Research in English* (Chicago: Scott, Foresman and Company, 1939), 60 pp.

[9] Broom, M. E. et al. *Materials for Reference Reading* (El Paso, Texas: The Public Schools, 1939), 66 pp.

ACHIEVEMENT IN SILENT READING IN AN ELEMENTARY SCHOOL

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Editor's note: Much has been written on the subject of reading. One of the most interesting facts brought out in Table I is the data on mean achievement and variability.

THE results of studies inquiring into achievements in reading at every school level confirm the general observation that our schools have not developed satisfactory reading skills in a large number of elementary and high-school pupils. We still find teachers who utterly fail to understand the individual differences of children and to meet their separate needs. The limited capacities of some children may account for their failure of retardation in reading. In most schools, however, the lack of adjusting the teaching program to the abilities and needs of each child from the time he enters school produces many cases of reading deficiencies which, with proper teaching technique, could have been prevented.

The study reported here was undertaken to determine the achievement in reading of the pupils of a parochial elementary school, to demonstrate to the teachers the necessity of better individualized instruction, and to enlist the cooperation of the Parent-Teacher Association of the community in providing funds for supplying each grade with reading material of varying difficulty and of a wide variety of interests.

The data of the study are derived from measuring achievements in reading of the pupils of an elementary school in a University city of the Midwest. Being parochial in character, this school draws the majority of its pupils from the Catholic people of the city who represent all classes—professional, industrial, merchant, artisan, and laborer. The community has a preponderance of well-to-do families. Accumulated records of the pupils furnished data concerning the socio-economic status and the mental ability of the subjects of our study. Regarding the former, scores obtained on the Sims Score Card for Measurement of Socio-Economic Status indicate that the great majority of the subjects of investigation live in desirable environmental circumstances. When treated statistically, scores derived from the Otis Self-Administering Test of Mental Ability, Forms A and B, administered to the pupils of Grade IV through VIII, the Otis Primary Test, ad-

ministered to the pupils of Grade III, and the Revised Edition of the Terman Binet Test, administered to the Pupils of Grades I and II, yielded average I. Q.'s of 105.91, 104.87, and 106.50 respectively.

The Gates Primary Reading Tests measuring separately word recognition, sentence reading, and paragraph reading, were administered to the pupils of Grades I and II. The Gates Silent Reading Tests for Grades III to VIII were administered to the pupils of Grades III to VII inclusive. These tests measure four types of reading ability: appreciation of the general significance of a passage, ability to predict the outcome of given events, ability to understand precise directions, and ability to note details. The tests require the pupils to read as many paragraphs as possible in a uniform length of time and to answer questions on the material read. The tests reveal in a general way reading achievements and reading deficiencies; the nature of indicated deficiencies remained to be determined later by means of diagnostic tests. Because of graduation being near at hand, the pupils of Grade VIII were not included in the present study.

For the purpose of considering problems of promotion and grouping pupils according to needs, all raw scores were translated into grade scores. Chronological ages and mental ages, too, were converted to equivalent meaningful grade scores, enabling teachers to detect at a glance those pupils who depart appreciably from the norms with respect to chronological and mental age on the one hand, and reading achievement on the other.

Table I presents, in terms of grade scores, the central tendencies and variabilities of chronological age, mental age, and reading achievement for the subjects of our investigation.

TABLE I

CENTRAL TENDENCIES AND VARIABILITIES OF CHRONOLOGICAL AGE, MENTAL AGE, AND READING ACHIEVEMENT, EXPRESSED IN GRADE SCORES

Grade Status	Chronological Age		Mental Age		Reading Achievement	
	Mean	S. D.	Mean	S. D.	Mean	S. D.
1.9	1.88	.29	1.93	.51	2.25	.73
2.9	2.85	.42	3.10	.84	2.80	.51
3.9	3.84	.53	3.99	.80	4.28	1.33
4.9	5.13	.41	5.24	.74	5.06	1.78
5.9	5.67	.38	5.92	.82	5.58	1.64
6.9	6.70	.62	7.10	1.39	6.75	1.85
7.9	7.77	.70	8.84	1.54	8.25	2.06

Data of Table I reveal a steady increase in reading achievement as well as invariability of achievement. We can easily account for the former; but why the latter should be four times as great in Grade VII as it is in Grade II merits careful inquiry. The values of the standard deviation indicate how far the middle 68 per cent of each grade deviate from the mean and permit a fair estimate of the approximate size of the highest and lowest reading achievement scores.

The average reading achievement of Grades II, V, and VI is .1, .32, and .15 of one grade below the national norm. In all but Grades I and III do we find a discrepancy between reading achievement scores and mental age scores, the latter being higher. This discrepancy between mental ability and reading achievement increases as children advance through the grades. Notice the considerably larger variability in reading grades than in mental grades. The only exception to this trend is in Grade II. Unless there are deficiencies other than intelligence, we are inclined to think that the bright pupils of Grade II are not properly challenged or are working with inferior reading technique which should be diagnosed and corrected.

Because of lack of space the individual pupil scores are here omitted. We should keep in mind, however, that the average scores listed in Table I convey a very incomplete picture. They fail to point out such children who, because of deficiency in chronological age at the time of school entrance, did not succeed in reading. Examination of the individual scores reveals vividly that unless such deficiency in chronological age is compensated for by an average or superior intelligence, by a rich reading background, etc., the pupil seems to have a small chance for attaining average level of achievement in reading. The individual scores, too, reveal amazing disparities between mental ability and reading achievement, not shown by the average scores. These discrepancies are too great to be overlooked; they call for a thorough diagnosis of factors entering into success in reading achievement other than mental age.

Undoubtedly, the wide dispersion in achievement of reading is the outstanding finding of our study. The matter is so important that a graphical illustration seems worth while.

The following figures demonstrate vividly the most basic single fact upon which to build remedial instruction. Notice the increase in variability from the lower grades to the higher grades. Study the rise in achievement

of the upper limits as the children advance in grades and the little progress made by the lower end of the class, causing the two ends of the distribution to get further and further apart.

We need not be surprised to find as wide a range in achievement in reading as this study reports. As the chronological-age grades indicate, quite a few children were initiated into the formal process of reading before they

Fig. 1. Grade scores of thirty-five first-grade pupils in a parochial school on the Gates Primary Reading Test

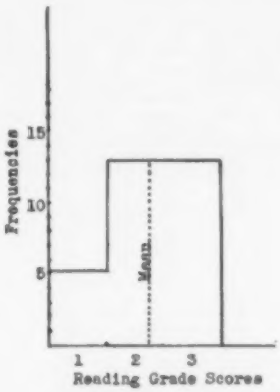

Fig. 2. Grade scores of thirty second-grade pupils in a parochial school on the Gates Primary Reading Test

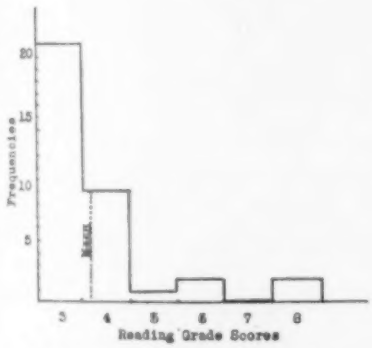

Fig. 3. Grade scores of thirty-four third-grade pupils in a parochial school on the Gates Silent Reading Test

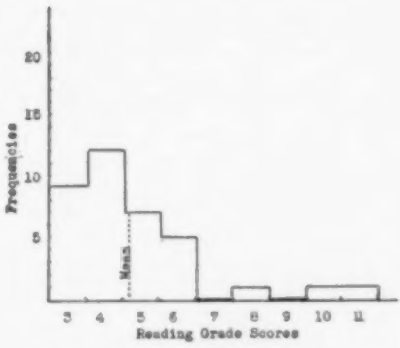

Fig. 4. Grade scores of thirty-six fourth-grade pupils in a parochial school on the Gates Silent Reading Test

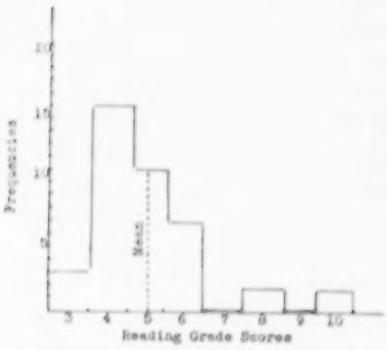

Fig. 5. Grade scores of forty-two fifth-grade pupils in a parochial school on the Gates Silent Reading Test

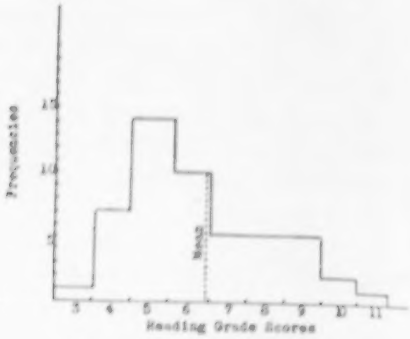

Fig. 6. Grade scores of fifty sixth-grade pupils in a parochial school on the Gates Silent Reading Test

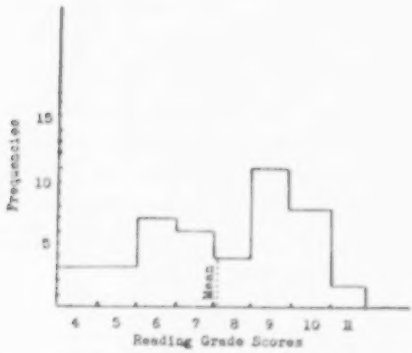

Fig. 7. Grade scores of forty-five seventh-grade pupils in a parochial school on the Gates Silent Reading Test

were chronologically and, probably, physically and mentally mature enough to undertake so difficult and complex an adventure as systematic reading. Perhaps some of the poor readers were handicapped by a meager experiential background or by social maladjustment.

Then, too, our present promotion policy is such as to promote children on the basis of chronological age rather than on the basis of achievement, which accounts for the accumulation in the upper grades of pupils with serious reading deficiencies.

Undoubtedly, the many different methods of teaching reading, the varying skill and experience of teachers, the methods of grouping children, etc., all contribute toward variation in reading achievement. Of course, individual differences in people are such as to preclude eliminating or greatly reducing variation in achievement; yet, many teachers still have a far way to go to adjust reading instruction to the individual needs of their pupils.

Investigations have shown that the mental age derived from careful testing of intelligence, is probably the best single criterion of reading ability. In our case, the intelligence tests from which the I. Q. scores of the children were derived, had been administered by the writer herself. To show the degree of concomitancy between reading achievement and mental ability, and reading achievement and chronological age, the Pearson Product-Moment Coefficients were calculated.

Table VIII lists the coefficients of a correlation for each grade.

TABLE II

RELATIONSHIPS BETWEEN ACHIEVEMENT IN READING ON THE ONE HAND AND MENTAL AGE AND CHRONOLOGICAL AGE ON THE OTHER

Grade	Reading and Mental Age	Reading and Chronological Age
I	.45 ± .08	—.12 ± .11
II	.13 ± .12	—.18 ± .12
III	.39 ± .09	—.12 ± .12
IV	.64 ± .09	—.05 ± .11
V	.45 ± .08	—.13 ± .11
VI	.39 ± .08	—.22 ± .09
VII	.63 ± .06	—.23 ± .10

The figures of Table II lead us to conclude that the relationship between mental ability and reading achievement is far from being perfect. Careful analysis of the individual scores revealed a number of children with mental-age scores justifying the prediction of normal or better achievement in reading; yet, their reading success was appreciably lower than their mental capacity, expressed in mental grades. These pupils present serious educational problems. As their general mental development is normal or better, their deficiency in reading can be explained only on the basis of some special defect which prevents the child from obtaining a reading record compatible with his mental ability.

In each separate grade, chronological age was found to correlate less highly with reading than mental age. The Pearson r's range from —.05 to —.23. The figures are only high enough to indicate the direction of relationship between chronological age and reading. In the upper grades the coefficients are slightly higher than in the lower grades, indicating, probably, the presence of over-age pupils, promoted on the basis of chronological age rather than on the basis of achievement.

Summary. As the first step toward the improvement of instruction in reading, the Gates Primary Reading Tests were administered to the first two grades, and the Gates Silent Reading Tests to Grades III through VII of a parochial elementary school. The average reading grades of Grades II, V, and VI were one, four, and two months respectively below the national norm. Grades I, III, IV, and VII were four, four and one-half, two, and four months respectively above the national norm. The spread of the reading scores was very wide, with an average range of 6.5 grades per class. This finding was interpreted as demonstrating the necessity for dividing the largest classes, engaging additional teachers, and for grouping the children for adequate reading instruction.

The bright pupils as a whole scored well above the average; yet, there were surprising discrepancies between their mental grades and their success in reading. The coefficients of correlation expressing the relationship between mental capacity and reading ability ranged from .13 to .63. The concomitancy of chronological-age grades and reading grades was found to point to a negative direction, the coefficients varying from — .05 to — .23. The rise of the coefficients from the lower to the upper grades can be explained by the accumulation in the latter of older, retarded, and low-performing pupils.

A very important result of the present survey study has been the stirring up of interest and enthusiasm of teachers and parents in ways and means of improving the reading achievement in the school. The former have taken a thorough course in Diagnostic and Remedial Reading; they have chosen the improvement of Reading Instruction for their theme of study in teachers' meetings and, under the supervision of the writer, they have organized a plan for further diagnosis and remedial instruction.

Parents have generously provided funds for the purchase of more than one thousand books suitable to the wide variety of interests and to the great spread of reading abilities of the groups and individuals within each group.

A STUDY OF PROGNOSIS IN HIGH SCHOOL ALGEBRA

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Editor's note: To direct student activities effectively one needs much information about the potential learner including knowledge of the pupil's probable success. The author presents data of the predictive value of certain prognostic instruments for Algebra.

THE rapid growth within recent years of our secondary school population has presented a very definite problem to school administrators, namely, that of placing the pupil in work that he is capable of doing. Some means is desired whereby those pupils who are not capable of doing the work of a course are discovered and placed in a course that will prove more profitable to them. This is especially true for the subject of algebra. This need has been seen by various investigators who have made attempts to predict a pupil's chances of success in algebra.

THE STUDY

The study reported here was made in the algebra classes of the Bailey Junior High School of Jackson, Mississippi in the year 1938–39. Here pupils of the ninth grade are given the choice of electing either the academic course in algebra or a course called General Mathematics. This latter course is the less difficult of the two and was placed in the curriculum in 1936 as an elective for those pupils not capable of profiting from the regular algebra course.

After using a standardized algebra prognosis test for two years with results that were seemingly average the author was prompted to make an investigation to determine, if possible, how well one might predict attainment in algebra with various criteria and with various combinations. If, as other studies indicate, one cannot predict accurately success in algebra for all pupils, how well can one predict within certain crucial limits? What tests should be employed for such measures? How significant are previous grades in eighth grade mathematics for predicting achievement in algebra? How does intelligence correlate with algebra grades? Does the individual's chronological age affect his achievement?

Pupils enter this school from five of the city's nine elementary schools. Two of these schools represent families that are average or below in finan-

cial circumstances while the other three, from which the majority of the students come, represent homes that are average or above in financial circumstances.

In attempting to get a representative sampling the study was made of all ninth grade pupils upon which complete data for all of the criteria could be obtained. The following tests were administered in the order mentioned:

Lee Test of Algebraic Ability—administered to all eighth grade students at the close of the previous school year.
New Stanford Arithmetic Test—administered to all algebra students during the first month of the school year.
Otis Self-Administering Test of Mental Ability—administered to all algebra students during the second month of the school year.
Cooperative Algebra Test—administered to all algebra students at the close of the school year.

Results from these four tests along with the eighth grade mathematics grades, algebra grades, and choronological ages were the criteria used in this study. Since all cases were excluded upon which complete data for all criteria could not be obtained, the number of cases was reduced from approximately two hundred to 141. Cases excluded were primarily of two types, namely, students taking the General Mathematics Course (approximately 30 in number) and students absent at some time during the giving of the four tests. This latter mentioned group was found to compare favorably with the 141 cases.

Numerical values were assigned to the letter grading system of this school, A, B, C, D, and F, in order to facilitate statistical treatment.

Prognosis was attempted by two methods—

1. Determination of prediction from correlations using
   a—Simple or zero order correlations
   b—Multiple correlations
2. Determination of prediction within certain crucial limits for—
   a—Predicting mastery* and superiority* (or lack of each) by single measures
   b—Predicting mastery and superiority (or lack of each) by various combinations

* Mastery—a score equivalent to an average grade of C + D, thought to be a necessary grade in order for a pupil to gain a profitable amount of good from the course (C = average grade, D = below average but passing)

* Superiority—a score equivalent to an average grade of B + C, thought to be a necessary grade in order for a pupil to gain a superior rank in the subject (C = average grade, B = above average).

Correlations of the various criteria used in the study are shown below in Table I.

TABLE I

CORRELATIONS OF THE VARIOUS FACTORS USED IN THIS STUDY

Criteria	a	b	1	2	3	4
a		.80	.55	.82	.67	.64
b			.57	.68	.63	.66
1				.50	.47	.67
2					.62	.62
3						.74

a—algebra grades
b—survey test results (Cooperative Algebra Test)
1—intelligence quotients (Otis Self-Administering Test of Mental Ability)
2—eighth grade mathematic grades
3—eighth grade achievement test results (New Stanford Arithmetic Test)
4—prognostic test results (Lee Test of Algebraic Ability)

The reader will observe that the coefficient obtained from a correlation of eighth grade mathematics grades with algebra grades is .82, the highest coefficient obtained. This would indicate that eighth grade mathematics grades are the most valid criterion of all those studied for predicting individual attainment in algebra. This indication is further substantiated by observing that the correlation obtained from mathematics grades and algebra survey test results is .68, which is higher than the correlation obtained from any of the other three variables, intelligence quotients, eighth grade achievement test scores, and prognosis test scores, with the survey test, .57, .63, and .66 respectively. It is well to note that the correlation of mathematics grades with algebra grades, which is .82, is noticeably higher than the same criterion with the algebra survey test results, which is .68. This may be explained by the uniformity that seems to exist in the grading system used in the mathematics classes of the two grades. It is to be noted that there are no teachers of algebra who had taught the pupils of this study in their mathematics of the eighth grade.

A study was made in multiple correlations to determine how much the prognosis would be improved or inhanced by a combination of I. Q. and eighth grade mathematics grades and also by combining all four variables. Since the I. Q.'s are available for the students when they enter the junior high schools, the use of the I. Q. with eighth grade mathematics grades might increase the validity for such prediction and still not entail additional expense to the school system. Such results are shown in Table II.

TABLE II

MULTIPLE CORRELATIONS OF CERTAIN FACTORS USED IN THIS STUDY

Algebra grades correlated with predictive measures		Algebra survey test results correlated with predictive measures	
r_{a2}	.82	r_{b2}	.68
$r_{a.12}$	.84	$r_{b.12}$	.72
$r_{a.1234}$	.86	$r_{b.1234}$	.76

a—algebra grades
b—survey test results (Cooperative Algebra Test)
1—intelligence quotients (Otis Self-Administering Test of Mental Ability)
2—eighth grade mathematic grades
3—eighth grade achievement test results (New Stanford Arithmetic Test)
4—prognostic test results (Lee Test of Algebraic Ability)

A combination of eighth grade mathematics grades and intelligence quotients when correlated with algebra grades gave a coefficient of .84; while a combination of all four of the variables correlated with algebra grades gave a coefficient of only .86, an increase of only two points in each case over the coefficient of .82 obtained by correlating eighth grade mathematics grades alone with algebra grades. This indicates further that eighth grade mathematics grades alone are practically as good as a combination of eighth grade mathematics grades and intelligence quotients or the whole combination of the four variables. A further study of the table shows an increase of four points when the combination of eighth grade mathematics grades and intelligence quotients is correlated with algebra survey test results and a further increase of four points when the combination of all four variables is correlated with algebra survey test results.

Upon further investigation a set of points was established in the predictive traits, eighth grade mathematics grades and intelligence quotients, below which one could be almost certain that no student would do satisfactory work and, likewise, another set of points below which no student would likely do superior work. It was found that any pupil (a) who made below 36 (obtained by averaging for an individual case the numerical values assigned to the letter grades) and had an I. Q. of below 110 or (b) either made below 25 on his eighth grade mathematics average or had an I. Q. below 95 did not attain mastery in algebra. There were 46 cases in this category, none of which attained the pre-determined level of mastery. Also, any pupil who had made (a) a score below 42 on his mathematics average from the eighth grade and had an I. Q. below 110 or (b) either

made below 40 on his eighth grade mathematics average or had an I. Q. below 109 did not attain a superior rating in algebra. There were 91 cases in this category, none of which attained the superior level. Likewise, for a similar study, one may be able to establish a set of points in the predictive traits below which one could be almost certain no students would do a definite type of work in algebra. However, such should be done only after the best criteria for prediction in a certain situation have been determined. Correlations will help in determining this.

A set of points could not be established above which one could be almost certain that a student would attain the level of mastery, nor, likewise, for the level of superiority.

In general, chronological ages play a negligible part in prediction. Correlation between chronological ages and algebra grades was found to be negative (— .25), indicating that the older pupils made the lower grades, a fact usually true due to retardation of such pupils.

CONCLUSIONS

In this particular study eighth grade mathematics grades were found to be a better basis for prognosis than either of intelligence quotients, eighth grade achievement test results or prognostic test results, a fact contradictory to many studies made in algebraic prognosis.

Reliance should not be placed on any one test or criterion but a careful study should be made of the individual school situation and the results used that show the highest predictive value.

Adequate and specially designed prognosis tests are still in the first stages of development and in many cases, as in this one, are found not to measure adequately what they are intended to measure.

There are certain uncontrollable factors such as health, energy, industry, and attendance which affect in some degree any attempt at prognosis; but this fact should not discourage any such study. Such prediction is a vital asset in the much needed guidance of our youth of today in electing the school work that will be most profitable to them.

Prediction of algebraic attainment is possible in high school, but when attempted the local situation should be carefully studied, for what may be the best criterion for one school situation may not be for another.

A METHOD OF MATCHING GROUPS FOR EXPERIMENT WITH NO LOSS OF POPULATION

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Editor's note: One of the difficulties frequently encountered in equivalent group experimentation is the loss of cases in matching. The author presents a regression method of pooling a number of measuring and matching.

IN ALL good controlled experimentation parallel groups are matched so as to secure equal prospect of progress for the matched groups apart from the differential effect of the experimental factor, so far as that is feasible. But such balancing of groups is nearly certain to compel the elimination of some members from one or both groups and thus to reduce the experimental population, with consequent decrease of reliability. The loss of population is likely to be especially great when we attempt to match groups simultaneously on several criteria, particularly if we insist upon pretty close equality. Since experiments are often conducted with groups of the usual classroom size, the numbers remaining after matching are likely to be disastrously small.

In this paper I shall set forth and illustrate a regression method which gives the effect of perfect pairing without the loss of any members from either the experimental or the control groups (unless, of course, there are such abnormal deviates as would be eliminated anyway on the ground that they do not belong to the population sampled). The method as here presented is not difficult to apply, in spite of a contrary impression which the reader might at first receive.[1] The method is equally applicable to matching on a single criterion or on a battery of criteria. I shall illustrate the technique with data from an experiment by Irvin J. Bearer, one of my graduate students, on the effect of introducing enriching "general language" material into the teaching of first-year Latin. The 28 members of the experimental group were taught such material on time taken off of the regular Latin period, while the 22 members of the control group gave all of their time to the straight study of Latin. Mr. Bearer made measurements of four aspects

[1] Since my development of this technique this same theme has been treated in a highly technical manner by Palmer Johnson and J. Neyman in *Statistical Research Memoirs*, Vol. I (University of London), pp. 57–93. It has also been treated as a form of analysis of covariance by Eugene Shen in *The Harvard Educational Review*, Vol. X, pp. 70–74 (Jan. 1940), and in The March, 1940, number of the *Journal of Experimental Education*. The Procedure derives, of course, from work by R. A. Fisher.

of achievement in Latin, of achievement in the enriching "general language" material, and attitude toward Latin.

Our method involves setting up a regression equation of the well-known rectilinear form based on the statistics of the control group, then predicting by it what should be the achievement scores of the members of the experimental group *if they were just like the control group members;* if, that is, the experimental factor produced no differential effect. We can, then, determine the differential effect for the experimental factor by the extent to which the average achievement of the experimental group exceeded or fell short of that predicted for it by the regression equation.

We shall illustrate the procedure where the groups are matched on two criteria, then shall show how it would work out for a single criterion and also how it would work for any number more than two. The matching criteria were IQ's from the Otis Self-Administering Test of Mental Ability and scores from a county eighth-grade examination. Six different end measures were taken. In our illustration we shall use only one of these—total Latin score. The content of the experiment itself is of interest, but we are concerned here more with the form than with the content. For that reason we shall give details of statistical procedure which would not customarily be given in a write-up.

In order to set up our multiple regression equation we need certain coefficients of correlation, certain means, and certain standard deviations from our control group. Let x designate the control group and y the experimental group; subscript 1 designates the general intelligence factor and 2 the eighth-grade examination factor, both initial measures for matching; 3 will designate the final achievement scores. But, for the sake of simplifying our notation, we shall employ the x and the y subscripts only where necessary to avoid confusion. Except where actually designated by y the statistics are from the control group and would be properly designated by x. The values of the statistics from the control group were as follows:

$$\begin{array}{lll} r_{13} = .438 & \sigma_1 = 7 & M_1 = 96.2 \\ r_{23} = .480 & \sigma_2 = 36 & M_2 = 361 \\ r_{12} = .722 & \sigma_3 = 11.8 & M_3 = 23.14 \end{array}$$

$$\beta_{13.2} = \frac{r_{13} - r_{23}r_{12}}{1 - r^2_{12}} = \frac{.438 - (.480)(.722)}{1 - .722^2} = .191$$

$$\beta_{23.1} = \frac{r_{23} - r_{13}r_{12}}{1 - r^2_{12}} = \frac{.480 - (.438)(.722)}{1 - .722^2} = .342$$

These β's are the standard partial regression coefficients for matching factors 1 and 2 respectively. For the sake of simplicity of notation we shall hereafter use for them β_1 and β_2 respectively. We can now write the partial regression equation:

$$X_{31} = \beta_1 \frac{\sigma_3}{\sigma_1} X_1 + \beta_2 \frac{\sigma_3}{\sigma_2} X_2 - (\beta_1 \frac{\sigma_3}{\sigma_1} M_1 + \beta_2 \frac{\sigma_3}{\sigma_2} M_2 - M_3)$$

$$= .322X_1 + .112\,X_2 - 48.309$$

Since we wish to predict what the scores for the experimental group (the Y's) would be if they behaved just like those of the control group (that is, if the experimental factor had no differential effect) we merely substitute for each member of the experimental group in turn his scores on the two matching criteria, and have

$$Y_{31} = .322Y_1 + .112Y_2 - 48.309$$

TABLE I

SCORES PREDICTED FOR, AND OBTAINED BY, THE MEMBERS OF THE EXPERIMENTAL GROUP, AND THE DIFFERENCES

Pupil No.	IQ	8th Gd.	Obtained score	Predicted score	Difference
1	86	352	19	18.807	+ .193
2	103	389	26	28.425	— 2.425
3	91	339	6	18.961	—12.961
4	101	370	27	25.653	+ 1.347
5	100	364	10	24.659	—14.659
6	99	355	34	23.329	+10.671
7	98	395	17	27.487	—10.487
8	97	356	33	22.797	+10.203
9	93	354	22	21.285	+ .715
10	96	385	31	25.723	+ 5.277
11	92	332	17	21.499	— 4.499
12	80	350	20	16.651	+ 3.349
13	92	340	18	19.395	— 1.395
14	98	345	24	21.887	+ 2.113
15	98	362	44	23.791	+20.209
16	90	337	41	18.415	+22.585
17	91	327	23	17.617	+ 5.383
18	91	350	23	20.193	+ 2.807
19	95	364	44	23.049	+20.951
20	91	325	21	17.393	+ 3.607
21	104	412	39	31.323	+ 7.677
22	81	329	25	14.621	+10.379
23	81	318	7	13.389	— 6.389
24	99	370	17	25.009	— 8.009
25	103	345	16	23.497	— 7.497
26	87	358	17	19.801	— 2.801
27	101	406	47	29.685	+17.315
28	97	379	24	25.373	— 1.373
Means	94.1	357.1	24.714	22.132	+ 2.582
σ^2					94.2

This is a routine process; if one uses a calculating machine, it moves very rapidly. The table below shows the predicted scores corresponding to the combined matching scores for the 28 pupils of the experimental group, and the differences between predicted and obtained scores.

It turns out that the scores actually obtained on the average by the experimental group exceeded those predicted for them. The mean of the attained scores was 24.714 and that of the predicted scores 22.132, a difference of 2.582. This tallies exactly with the mean of the column of differences, as it must if the arithmetic is correct. So, the group which had the general language material on time subtracted from their total to Latin did not do worse in achievement in Latin than the control group which devoted the whole time to Latin; on the contrary, it did a little better, though by only .22 of a standard deviation. But is this a chance difference, which might disappear with further sampling? To answer that question I have developed a formula for the standard error of this type of difference.[2] For the case of matching on two criteria it is, where y stands for an attained final score and y' for a predicted score and the bar over a letter shows that the mean of the array is meant,

$$\sigma_{\bar{y}'-\bar{y}} = \left\{ \frac{\sigma^2_y(1-R^2_{y\cdot 12})}{N_x - 1} + \frac{\sigma^2_{y'-y}}{N_y - 1} + \frac{\sigma^2_y(1-R^2_{y\cdot 12})}{N_x - 1} \left[\frac{(M_{x_1} - M_{y_1})^2}{\sigma^2_{x_1}(1-r^2_{12})} + \frac{(M_{x_2} - M_{y_2})^2}{\sigma^2_{x_2}(1-r^2_{12})} \right] \right\}^{1/2}$$

The R^2 here is the square of the multiple correlation coefficient between the final scores of the control group and the matching team, and is most easily found by

$$R^2 = \beta_1 r_{1y} + \beta_2 r_{2y}$$

the β's being the ones for which we found values above. Substituting these values we have, for this experiment,

$$\sigma_{\bar{y}'-\bar{y}} = \sqrt{5.1665 + 3.4896 + 1.0979} = 3.12$$

Thus the difference is 2.582 while its standard error is 3.12. The standard error ratio, t, is the former divided by the latter, which gives .83. The difference is not statistically significant. As large a difference as that

[2] The proof, and aids for the use of the formula, are given in Peters and Van Voorhis, *Statistical Procedures and Their Mathematical Bases*, revised and enlarged edition (The McGraw-Hill Book Company, 1940), pp. 464–465.

could arise merely by chance fluctuation of sampling 20 times in a hundred even if the true difference were zero. There is, however, a little plausibility afforded to the hypothesis that pupils who are given general language materials in a Latin class will achieve more rather than less academic success in conventional Latin than a similar group taught only conventional Latin; the odds are four to one that the true difference would be found in favor of the former if the experiment could be indefinitely extended.

In the case of k matching factors the partial regression equation would merely be extended to the kth order, the multiple R would be correspondingly increased in order, and we would have in the third term of the standard error formula k addends instead of two, each divided by a partial sigma of the kth order. Formulas for the calculation of these partial sigmas are given in the Peters and VanVoorhis reference cited above. For a single matching factor the simple regression equation would be used and the standard error formula would reduce to

$$\sigma_{\bar{y}'-\bar{y}} = \sqrt{\frac{\sigma^2_3(1-r^2_{12})}{N_x-1} + \frac{\sigma^2_{y'\cdot x}}{N_y-1} + \frac{\sigma^2_3(1-r^2_{12})\,(M_{x_1}-M_{y_1})^2}{(N-1)\sigma^2_{x_1}}}$$

If, in accord with small sample technique, one wishes to interpret the probability in terms of Student's distribution instead of the normal distribution, one should use as divisor under the radical $(N-k-1)$ instead of $(N-1)$, where k is the number of matching factors; and he should enter Student's (or Fisher's) table with (N_x+N_y-2-k) degrees of freedom. But this will give appreciably different results only if the populations are very small, say the populations of the experimental and the control groups combined are less than thirty-five individuals.

It is the third term of the standard error formula that involves most extra labor, especially as the number of matching factors is increased. This term makes comparatively little difference in the outcome, and could be omitted with only a little underestimate of the standard error, especially if the groups are not far apart in means of matching factors. In the case of our example the standard error would have been reduced from 3.12 only to 2.94, which would not have materially affected the practical interpretation of results.

In order to forestall criticism regarding my standard error formula, a word may be said about it. It was developed to meet the case where one intends the standard error formula to answer the question: What is the

standard deviation of the mean differences we should expect if we took a large supply of samples from the same population *each time selecting both a new experimental and a new control group?* That seems to be the natural way in which to think of the sampling universe we are intending to describe in the situations in which we employ a technique like this one. This is what is meant when we deal with matched group experiments of the conventional type and employ the formula

$$\sigma_{m_1 - m_2} = \sqrt{\sigma^2_{m_1} + \sigma^2_{m_2} - 2r_{12}\sigma_{m_1}\sigma_{m_2}}$$

My formula gives results identical with this one when the conditions are similar. But one *could* refer by his standard error to a succession of experimental groups *always referred back to the original control group as basis.* Then the standard error formula would contain only the middle term under the radical. This has been proposed to me several times, but I have rejected the proposal because this does not seem to me to be a very natural or realistic thing to mean—an infinite supply of samples in which only the experimental group changes while the control group remains the same. Nevertheless, one can mean that if he chooses, and should then employ the proper formula to express what he means. A very large proportion of the controversies over what is the correct standard error formula in various situations really grows out of ignorance of the fact that each formula defines the behavior of a certain type of universe of samples; and very different formulas, which give very different arithmetic outcomes, may all be correct, each for the type of situation it was developed to describe. The error comes only when a worker employs a formula for one sampling universe when he really means to refer to another sampling universe; or, which probably occurs still more frequently, when he uses the formula without knowing what he means.[2]

Mr. Bearer applied the procedure described above to the sectional scorings of the Latin test and to a measure of "general language" achieve-

[2] My formula parallels those offered by Shen in the articles previously cited except that Shen combines the estimates of the variances from the experimental and the control groups into a single estimate, as is the Fisher way when testing the null hypothesis; he similarly combines the estimates for r's; and his degrees of freedom are adjusted for use with Student's distribution. Because of the slightness of these modifications, Shen's formula will give results that differ only negligibly from mine except when the N's are extremely small.

ment. He also compared attitudes toward Latin on the part of the two groups as measured by the Remmers scale. The following table displays the results.

TABLE II

SUMMARY OF THE COMPARISONS OF ACHIEVEMENT AND OF ATTITUDE OF THE CONTROL AND THE EXPERIMENTAL GROUPS

Test	Difference in means	Standard error	Standard error ratio	Chances true true Dif. on same side
Latin Comprehension	+ 1.25	1.83	.68	75 in 100
Latin Vocabulary	+ 1.70	1.70	1.00	84 to 100
Latin Grammar	— 0.64	1.60	.40	65 in 100
Total Latin	+ 2.58	3.12	.83	80 in 100
General Language	+19.52	2.74	7.1	"certain"
Attitude Toward Latin	+ 0.82	0.63	1.30	90 in 100

This shows an advantage for the experimental group in all comparisons except that on knowledge of Latin Grammar, where the negative difference is very small. In knowledge of the enriching materials constituting "general language", which were systematically taught to the experimental group but which the control group had some opportunity to pick up incidentally, the odds were overwhelmingly in favor of the experimental group. This finding is confirmed by a similar one by Eaton.[3] It is also paralleled by the findings reported by Porter from three Penn State experiments showing that one day a week may be taken from the study of high school mathematics and devoted to mathematical recreations with resulting attainment of greater rather than less academic masteries of conventional mathematics.[4]

SUMMARY

In this article I have

1. Set forth and illustrated a regression technique for matching groups in a controlled experiment with no loss of population.

2. Given experimental evidence suggesting, though with fairly low reliability, that time may be taken from the conventional teaching of Latin and put on supplementary enriching "general language" material without loss in conventional Latin achievement, or possibly even with superior gain.

[3] Eaton, Helen S. "Experiments in Language Teaching", *Modern Language Journal*, XIX (October, 1934), pp. 1–4.

[4] Porter, Rutherford B. "The Effect of Recreations in the Teaching of Mathematics", *School Review*, XVIL (June, 1938), pp. 425–427.

EDITORIAL

EVERY SCHOOL A WORKSHOP

ANYONE associated with professional education for any length of time has seen many devices, techniques, and slogans come and go. The history of education contains the records of many more. There are gains and losses arising from these special emphases. In general devices arise out of long felt needs and pass out of the lime light when the immediate urgency has passed. The workshop seems to fall in this category. Nevertheless, it would seem to have a very definite contribution to make to professional education. Designed for a special purpose, it seems particularly well suited at present as an instrument for effective instructional leadership and the training of teachers in service.

There are ordinarily some basic needs, principles, and conditions underlying the discovery and application of new techniques and devices. For some time college instruction, including work in professional education, has been under attack as formal and academic and divorced from practice. The workshop has reemphasized the importance of a number of educational needs: 1) the importance of the felt needs of teachers, supervisors and administrators as the focal point of professional education, and the importance of a problem solving approach; 2) the importance of the social values arising from a co-operative attack upon one's problems; 3) the importance of expert leadership; 4) the importance of bridging the gap between theory and practice; and 5) the importance of performance as opposed to the mastery of subject matter as the goal of professional education.

As has been already suggested, the workshop was designed for a special purpose and has later become associated with the institutional training of teachers, supervisors and administrators. In advancing the thought that the workshop might be appropriate for the training of teachers in service and the improvement of the efforts of field workers, the writer would like to call attention to five particularly important and pressing field needs:

1) the need for extensive revisions of the school's instructional program to meet changed social conditions; 2) the need for utilizing as far as possible the best of current science and philosophy in the reconstruction of educational programs; 3) the need for presenting a unified and concerted attack upon educational problems, locally, in particular schools, and from day to day; 4) the need for practice in democratic methods of solving problems by those close to the scene of action and responsible for the educational leadership of school boys and girls; and 5) the need for the continuous re-evaluation of the generalizations of the laboratory and cloister under the conditions of field work. All of these very pressing present day needs might be met quite effectively if every school were a workshop where teachers, pupils and supervisors might work together harmoniously and cooperatively for the solution of their everyday school problems. This may, of course, involve some changes in school organization to meet new conditions.

In some respects the workshop may be better suited to the conditions of field work than to those of institutional training: 1) The workshop presupposes a problem consciousness. The school has plenty of problems. Of course, teachers can bring their problems along with them to teacher training institutions, but there may be some advantage in being closer to the scene of action. 2) To solve the problems of particular teachers, pupils and supervisors working under particular conditions, one needs to know the persons, purposes and conditions involved. Most institutional workshops are far removed from these. 3) Frequently special equipment and particular sorts of instructional materials are essential to effective work; there are many such needs, running all the way from valuable laboratory equipment in a reading clinic, for example, to ordinary library facilities. The average public school is not particularly well equipped in this respect. 4) Opportunities are needed to try out the ideas and materials evolved to see whether they work. There are lots of ideas and theories that seem sound and valuable until some one attempts to use them. More of our educational theories need the test of practice and systematic evaluation under the conditions of field work. Systematic evaluation under field conditions should be an important function of every workshop. 5) Expert leadership is needed. This leadership is lacking in both institutions and the field. Possibly some working combina-

tion of the two might be devised. The apparent lack of leadership for new undertakings of this sort should offer a first rate challenge to the profession.

While techniques are techniques and should be accepted for what they can do, the workshop seems to possess many features of merit especially suited to the needs and conditions of field work, today, and as we now work. It would seem to offer a new opportunity for democratic leadership and the cooperative solution of our everyday school problems.*

A. S. BARR.

* For an excellent discussion of the workshop see: Heaton, K. L., Camp, W. G., and Diedrich, P. B. *Professional Education for Experienced Teachers* (Chicago: The University of Chicago Press, 1940), 142 pp.

REVIEWS

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CROWTHER, J. G. *The Social Relations of Science.* (New York: The Macmillan Company, 1941), pp. xxxiv + 665. $3.50.

ZNANIECKI, FLORIAN. *The Social Role of the Man of Knowledge.* (New York: Columbia University Press, 1940), pp. viii + 212. $2.50.

In the December, 1940, number of the Journal, Bernal's, *Social Function of Science* was reviewed briefly. Crowther's, *Social Relations of Science* elaborates essentially the same thesis, with a much larger portion of his book devoted to tracing historically the relation between science and society from primitive man through Greek, Roman, Muslim, medieval, and modern civilization. The book is divided into 83 relatively short sections, including many hundreds of examples of the problems discussed. The author is scientific correspondent of the English paper, the *Manchester Guardian*, and lectured in 1937 and 1938 in the United States. He emphasizes that science is a determining factor in the destiny of mankind and that a social policy for science must be formulated to guarantee that such knowledge will be used for the welfare of society. It is suggested that the next advance toward an improved scientific method may be through a combination of the present scientific method, which is generally considered as independent of society, with social understanding. The social responsibilities of scientists are summarized as follows: (1) to expose errors in science; (2) to organize intellectual criticism by cooperative effort; (3) to demonstrate the relations between science and social affairs; (4) to describe the social improvements desirable for the advancement of sciences; (5) to persuade scientists who keep their scientific and political ideas in separate compartments to support constructive movements on the ordinary political grounds of economic interest and social justice; (6) to establish contacts with governmental agencies so that no major political decision can be made in ignorance of pertinent scientific knowledge; (7) in time of peace, to cooperate with all constructive social and intellectual movements, to expand science, and to remove the causes of war; and (8) in war, to consider which side is the less inimical to science and then work to prevent its defeat.

Znaniecki, a sociologist, in a rather abstract theoretical discussion, asks whether there is any relationship of functional dependence between the social roles which scientists perform and the kind of knowledge which they cultivate. He concludes that the closest cooperation between technology, philosophy, and objective science is necessary. The technological leader needs the guidance of the sage in determining the effect which the con-

templated activity will have on society; the role of the philosopher seems destined to increase in importance with the development of social planning. In turn, the philosopher needs the results of scientific investigations to aid in the formulation of evaluative criteria. Technology, too, should strive to make practical applications of the discoveries of science. The author describes at some length how society has granted status and rewards to the scholar, whose activities have such intangible value to society, in order that he may be unhampered in the discovery, organization, and transmission of knowledge.

Such books as these and the present world scene present sober testimony that on the proper relation of science, technology, philosophy, a system of values, and society depend the welfare and even the very existence of science, research, and mankind.

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KELLY, ROBERT LINCOLN. *The American Colleges and the Social Order* (New York: The Macmillan Company, 1940), pp. xi + 380. $2.50.

BROWN, KENNETH IRVING. *A Campus Decade: The Hiram Study Plan of Intensive Courses* (Chicago, Illinois: The University of Chicago Press, 1940), pp. ix + 133. $1.50.

These two books are concerned fundamentally with the same problem, namely, the role of the liberal arts college in American society, but they approach their tasks in widely differing ways. Mr. Kelly has set for himself the task of surveying the whole field of college education as viewed from his perspective as executive director of the Association of American Colleges during the two decades 1917–1937. Mr. Brown has approached his task from the point of view of the changes made in one small liberal arts college while he was its president during the single decade 1930–1940.

The title of Mr. Kelly's book, "The American Colleges and the Social Order," is a stimulating one and holds out the hope to the reader that it will present a thoroughgoing discussion of the social relations of colleges. Mr. Kelly ranges over nearly all of the possible topics in which college educators would be interested. He touches upon the historical development of college aims and practices from colonial times to the present; he cites many social trends that have affected colleges in the various stages of their history; he deals with experiments of various kinds ranging from curriculum changes and individualized instruction to international affairs and junior colleges; he deals with problems of academic freedom, college finances, publicity, propaganda, and college associations and organizations; he points to relationships between colleges and churches and between colleges and states; and he sets forth his own philosophy of what college education should be.

Throughout this discussion on a wide canvass, Mr. Kelly reveals himself as essentially conservative in attitude and optimistic that the colleges have made great contributions to American society in the past and that they will continue to do so in the future. This reviewer had the impression that the book hits so many high spots so hurriedly that a reader needs to be forearmed with a good background in the history of American society and the history of higher education or else the sketchiness of much of Mr.

Kelly's discussion will leave him somewhat lost in the valleys between the high spots.

Mr. Kelly's concern and sympathies throughout seem to lie on the side of the small, private, religious, liberal arts college rather than with the large, public, secular college or university. This preference is not clearly admitted in so many words by the author but it shines through much of what he writes. He gives very little attention to the public institutions except to indicate incidentally that they now enroll the majority of college students in the United States. The author apparently believes that private institutions are the genuine carriers of the "spiritual" values in the social order and in so far as they are free from state control they are preserving the American tradition (page 294). Lotus Coffman is quoted as opposed to federal control of higher education, but no mention is made of his superb statements concerning the function and purposes of state universities.

Mr. Kelly's philosophy of higher education seems to be that colleges should remain in close touch with the current problems of society but should not be guided by them. The colleges should serve as "social balance wheels, thermostats, governors in the total machinery of a free society. The colleges help to steady the ship of state . . . They cannot be expected, chameleonlike, to change the color of their skins in response to every external stimulus or pressure. While they are in the current of events they are fortunately not of it. They strive to preserve the objective view." (page viii) In other words, the colleges should push forward when society lags behind and they should hold back when society seems to be moving too rapidly. Unfortunately, however, Mr. Kelly does not define very clearly what kind of social order he has in mind and thus the reader is at a loss to judge whether the colleges at a given time should push forward or hold back. He merely says that colleges should try to serve the "general welfare" of a society presumably based upon democracy and freedom. He does give a suggestion of what a "free" society means to him when he urges the preservation of our traditional freedoms of speech, thought, worship, press, assembly, and also the "freedom of enterprize" (page 336). This reviewer found little attempt to take account of the world-shaking social forces that one might expect in a book dealing with the social order in 1940.

According to Mr. Kelly, the colleges of America apparently serve society best by training individuals to take their places of leadership in society rather than by attempting to deal institutionally with the problems of society. He states specifically that a college should not have a point of view as an institution but serves its purpose when it embraces all kinds of points of view and allows the student to decide for himself what he will accept. The college must "postulate the human spirit as the basis of its work" and must have its windows open wide in every direction in order to accept any "eternal values" that may come from the social, scientific, and religious worlds. One might suppose that a forward-looking philosophy of higher education in these days would postulate a more dynamic loyalty to democracy and a more explicit desire to make our society democratic through students who will become loyal and effective democrats. Mr. Kelly's primary plea for higher education is that

the small, four-year liberal arts college be maintained and that it avoid the weaknesses and dangers of the democratic spirit in education (page 78) by adhering to an ideal of intellectual aristocracy rather than embracing a Jacksonian democracy that would admit virtually everyone to college.

In contrast to the broad scope and sweeping generalizations of Mr. Kelly's book, the story of Hiram College that Mr. Brown tells is succinct and vivid as he gives a running account of the events connected with the establishment of a new plan of intensive courses. Reacting against the disconnected smattering that often occurs when students take five different courses in one semester, Hiram College has designed a series of intensive courses whereby a student may spend nearly all of his time upon a single course during a given term. The case for and against such a plan is clearly and fairly stated in terms of faculty strivings and misgivings. Especially interesting is the picture of democracy at work as a faculty embarks cooperatively upon a new venture. The reader feels that perhaps every college faculty ought to try working in such a manner if the educative process is to become a truly worthwhile and exhilarating experience for both students and faculty.

In his way, Mr. Brown also makes a plea for the small liberal arts college in American society, but he recognizes that it has a special rather than exclusive contribution to make. He sets up three areas of special usefulness: the advantages of a faculty that is primarily concerned with teaching rather than with research; the advantages of informal and personal relationships between faculty and students; and the advantages of the healthy and morally wholesome atmosphere that arises from a pervading religious faith. Despite the difference in size and the relative emphasis given to these two books in these columns, this reviewer has the impression that Mr. Brown's discussions will be the more satisfying and rewarding to college educators who are interested in the future of the liberal arts college in American society.

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Dunklin, Howard T. *The Prevention of Failure in First Grade Reading* (New York: Bureau of Publications, Teachers College, Columbia University, 1940), pp. vii + 111. $1.60.

Non-readers and retarded readers can be taught to read at the level indicated by their abilities in practically every instance if proper diagnosis and remedial techniques are used. Ordinarily the remedial work, when undertaken, occurs only after the child has had one or more grades in school and has become a reading problem. Is it possible for many of these children to succeed from the outset of their work in reading? This report suggests that they may if the instruction in reading is adjusted to the abilities and interests of the children from the beginning.

A tentative program was derived from a survey of the literature concerned with primary reading. This program was then tested out in a well-controlled experiment. From prospective reading failures two matched groups were chosen, one the experimental and the other the control group. The experimental group, made significantly greater progress than the control group. In fact, the former group, at the end of the year, had an average

silent reading score of 2.07, or .17 of a grade above the established norm. Only 11.1 per cent of the experimental group failed to reach the norm while 55.5 per cent of the control group fell below it. It was concluded that reading failures in the first grade can be prevented to an appreciable degree by adequately adjusted instruction. Furthermore, this instruction can be carried on by the regular classroom teacher.

It is refreshing to find an author who can talk about the essential left-to-right perceptual sequences that must be developed in reading, without recourse to the overworked ritual of eye-movement pacing. There are in this excellent treatise, however, a few points that may be adversely criticized. Many will consider that, in view of the evidence, too great emphasis has been placed upon physiological status as a factor in reading disability. Furthermore, there is too little weight given to oral reading with beginners. Unfortunately, although it is stated that much material has been published that is suitable for adjusted instruction, no list of these books is given.

Perhaps the suggestions put forward in this book need further experimental checking. Nevertheless, the author's program of adjusted instruction is worthy of serious consideration by all educators interested in improving reading instruction in the elementary grades.

MILES A. TINKER.
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KIRK, SAMUEL A. and MONROE, MARION. *Teaching Reading to Slow-Learning Children* (Boston: Houghton Mifflin Company, 1940), pp. xi + 225. $1.50.

Unfortunately little attention has been devoted to the development of teaching techniques that are suitable for promoting satisfactory reading progress in the mentally retarded child. Hence children with low I. Q.'s are frequently even less proficient in reading than would be expected in terms of their mental level. The present text is, therefore, timely. Dr. Kirk states that "the purpose of thi. book is to present to teachers and administrators the problems and techniques of helping the slow-learning child acquire the skill of reading". All the devices for the improvement of reading presented by the author have been evaluated and adapted to the learning ability of the backward child. Included are discussions of the problem involved, the reading status and pre-reading activities of mentally retarded children, introduction to and improvement of reading, diagnosis of disability, and remedial instruction. There is also a selected list of references and tests.

Adequate treatment is given most of the conditions which determine and promote reading proficiency in the mentally retarded. The view that physiological factors are minor determinants of reading ability is well taken. Strong emphasis is given the limitations imposed by mental status. Nevertheless, the author accepts uncritically the notion that the I. Q. may be markedly altered by environmental factors. Unsubstantiated data are cited suggesting that I. Q.'s may be raised 30 to 40 points. In view of the important evidence questioning the validity of these studies it is unfortunate that data of this kind should be accepted and promoted as truth in textbooks.

The discussion of the need and nature of pre-reading training and initial reading instruction is excellent. Emphasis upon oral reading as a basis for silent reading is well taken. There are im-

portant modifications in techniques of teaching reading to slow learners in comparison to those applied to normal children, i.e., teaching of phonetics, details in words and relative emphasis upon speed and accuracy, etc. In general, the remedial method outlined here is, in the initial stages, primarily a modified phonic technique with considerable emphasis upon perceiving details in words.

This book is characterized by a clear statement of methods which have proved successful in practice. It should be considered one of the more important of the recent contributions to diagnostic and remedial reading.

MILES A. TINKER.
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JONES, THERESA DOWER. *The Development of Certain Motor Skills and Play Activities in Young Children* (New York: Bureau of Publications, Teachers College, Columbia University, 1939), pp. xiv + 180. $1.85.

Dr. Jones' work, the longitudinal type of genetic study, inquires into the motor development of pre-school children as revealed by their use of four kinds of wheel play materials: wagon, doll carriage, kiddie car with pedals (tricycle at 36 and 48 months), and dump truck representing the "pull", "push", "pedal" and "transportation" types of vehicles. Twenty-four children, twelve (six boys and six girls) representing the higher and twelve (five boys and seven girls) the lower socio-economic groups, were observed repeatedly once a month from age 21 months to 33 months, again at 36 months and at 48 months. Observations were made both in a standardized playroom and in the homes; the records thus obtained were supplemented by mental test records, height, weight, characteristics of home environment, etc. The major interest centered about the stages through which preschool children pass in the use of the chosen types of play materials. The procedure used in the investigation was very carefully planned on the basis of preliminary studies; the record form for playroom observations included a floor plan drawn to scale; a new one was used each minute of a forty-minute observation period divided equally between each of the four types of vehicles. There were in the main 319 observation periods in the controlled environment and 208 in the natural home environment.

Measures of reliability were obtained in respect to: a) reliability of worker's records of behavior, the result being a 90% to 100% agreement between 30 forty-minute observations recorded by two workers at the same time; b) reliability of worker's records as to amount of locomotion by the vehicles and amount of other activity, correlations being .99 and .96 respectively between 20 ten-minute observations recorded by two workers at the same time; c) consistency of performances, the result being 80% to 100% agreement between forty pairs of observations made by the worker within three days of time; d) age of achieving given levels of performance, the result being 92% to 98% agreement between two independent examinations of the data by two workers.

The data were treated in four ways. First,—the detailed uses of the four wheel play materials were classified into four major categories a) manipulation of parts, b) pulling and pushing, c) propelling, d) combination of other play materials with the wheel play materials.

Second,—the behaviors under each of these four main categories of use were scaled according to levels of skill and performance, each category having three to four levels irrespective of vehicle. For example the four levels for pushing and pulling are: I Within limited space; II In a continuous manner; III With control and direction; IV Over obstacles.

Third,—closely associated with classifying the behavior according to levels of skill and performance was a determination of the range and median age at which the children achieved a given level of performance in each category of use with each vehicle.

The four categories of use are the same for all four types of vehicles and transcend the vehicle types in importance in satisfying the child's growth needs and interests. Categories a) and d) which wholly or in part include non-locomotor activities show a general trend of sequence in development as listed; categories b) and c) are locomotor activities and show a general trend of sequence in development as listed. However age medians indicate certain levels of performance within two or more categories appearing at the same time. A brief picture of the developmental pattern as disclosed by the study is as follows: Unskilled repetitive handling of parts, pulling and pushing within limited space, combining play materials with stationary vehicles at 21 months; selective attention to and examination of parts, pulling and pushing continuously at 22 months; pushing and pulling with control and direction, attempts at propelling at 24 months; pulling and pushing the vehicle with play materials at 25 months; pulling and pushing over obstacles at 28 months; propelling for at least 7½ feet at 29 months; arranging play materials in the vehicles at 31 months; using parts skillfully and purposefully at 32 months; propelling skillfully at 36 months; transferring play materials to a destination at 48 months. A general pattern of emergence of powers may be thus described: Unskilled repetitive unconnected activities manipulative in nature for getting acquainted with the play materials from 21 to 24 months; increase in neuromuscular controls from 24 to 26 months, followed by the practice of skills to gain power over the play materials from 26 to 36 months; prevalence of the practice of skills, but also since less attention to performance is required prevalence of the use of a variety of activities gradually to be merged into an integrated "thought before action" activity which for those who have mastered the handling of the vehicle takes the form of imaginative play at 36 months; the use by the median child of the play materials in a continuous, larger enterprise usually imaginative in character, in which the performance of the skills now largely automatic is secondary to the project as a whole at 48 months.

A fourth method of handling the data was by the use of the method of analysis of variance* for the purpose of inquiring into the differences in performance as they relate to a number of factors. This work revealed among others the following main observations: 1) the presence of highly significant differences among levels in terms of age performance, indicating a close relationship of these levels to age; 2) the absence of signifi-

* 1) R. A. Fisher, Statistical Methods for Research Workers.

2) G. W. Snedecor, Statistical Methods

cant differences among the four types of vehicles in terms of age performance indicating that any of the vehicles will serve for the activities studied; 3) significant differences between "ownership" and "non-ownership" groups in the locomotor activities (pulling, pushing, propelling), not so in the manipulative activities or in combination of play materials; 4) no significant differences between the children of the higher and lower socio-economic groups; no significant differences between sexes in terms of age performance in manipulations of parts and in combination of play materials; while the sampling was too small to reveal sex differences in the locomotor activities.

Although Dr. Jones states that a more detailed study is necessary in order to determine the relative place of maturation and training in the activities studied the present work strongly suggests the importance of the maturational factor in developing the underlying ability to acquire certain skills by the following findings: 1) apparent "saltatory" growth of the skill and strength forms of behavior, as propelling, in contrast to the more gradual growth of behaviors which are less dependent upon these physical abilities, as combining play materials; 2) the emergence of general "levels" of performance within limited age ranges; 3) the success in pedalling the kiddie car at comparable ages despite great differences in opportunity to practice; 4) great similarity in performance of certain activities at a given age regardless of the material used; 5) similar age attainments of certain performance levels but possibility of difference in interest, and in quality of performance, the latter depending upon amount of practice; 6) final emergence of an apparently dormant skill which is unpracticed because of adverse environment limiting experience and inhibiting activity.

Among a large number of further findings are the following: 1) evident consistency in acceleration and retardation; 2) increase of attention span with age; 3) the age ranges when each wheel play material seemed to serve best the interests of the child as judged by greatest variety of uses (order: doll carriage, kiddie car, wagon, dump truck); 4) the vehicle (wagon) best utilized in social situations and giving most promise for extension of use beyond 48 months; 5) correlation of certain performances with weight, likewise with intelligence, some of which were as high as .50 and statistically significant; 6) sex similarities indicated by the uniformity of age of performance levels in the non-locomotor activities in which sex differences in interest were shown; tendency toward better performance by the boys on the advanced levels; 7) influence of positive and negative emotions, both types tending to be associated with a less degree of use of play materials and greater retardation; 8) association of acceleration with spontaneity, self-reliance, less emotionality, tendency toward much activity and use of play materials; association of retardation with s o c i a l dependence, greater emotionality, and tendency toward inactivity; 9) spontaneous and greater use of and self-reliance in use of play materials associated with homes characterized by siblings just older than subject, no maid or extra adult in family, many play materials, and outdoor play space; 10) participation in "planned" activity accelerated in children who play with siblings just older than themselves.

Among a number of practical conclusions which proceed from the study are: 1) since the levels of performance are functions of increasing maturity a knowledge of the tentative norms as set by the study will be helpful to those responsible for the development of the young child in order that the uses of the wheel play material will be encouraged at the most fruitful times without discouragement to the child or disappointment to the parent; 2) since the locomotor skills which are a result of neuromuscular maturation can be improved at each level of performance by practice, the presence of wheel play materials in the natural environment is important; 3) added reason for providing opportunities for frequent practice lies in the fact that children whose performance at a given level is minimum, tend to overpractice the other uses of the play material; 4) furthermore such children should be aided by being given training in the skills of their age; 5) since self-reliance and absence of emotionality are associated with more use of play materials and acceleration in use an environment conducive to the development of these traits is indicated; 6) since prevalence of practice of skills to gain power over the play materials marks a stage in the general growth pattern which precedes participation in the larger enterprise involving planning, imagination, integration, then all the foregoing items which influence practice have added significance as means to insure full development. Recommendations concerning the selection of wheel play materials include the following: the doll carriage is most appropriate for 18 to 24 months as far as the uses made of it by children under four years are concerned; the kiddie car is best at ages 20 to 24 months followed by tricycles according to size; the dump truck is good throughout the period to four years of age; the wagon best for social play can be delayed until three years of age when children play more together.

The study of Dr. Jones is a significant contribution to the panoramic picture of child development which is much needed not only by workers with preschool children but also by those of us who are endeavoring to provide for further development in the motor skills and play activities on the elementary school level by basing such provisions upon scientifically obtained facts concerning the genesis and growth of motor and play patterns common to the play life of children of the elementary school. The careful work of Dr. Jones and the many facets upon which it touches not only satisfies but also increases the thirst for more such highly commendable research dealing with the development of motor skills and play interests.

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Research Abstracts and Bibliographies

Address all communications relative to research abstracts and bibliographies to A. S. Barr, University of Wisconsin, Madison, Wisconsin.

BULLETINS

CALIFORNIA CONSERVATION COUNCIL. *California's Natural Wealth: A Conservation Guide for Secondary Schools,* Bulletin of the California State Department of Education, IX, No. 4 (Sacramento: California State Department of Education, December, 1940), 124 pp.

A survey of the natural resources of the state of California for secondary schools.

DIVISION OF CHILD ACCOUNTING AND RESEARCH. *Education and Teaching Experience of the Instructional and Administrative Employes in the Public Schools of Pennsylvania, 1938–1939,* Research Service in Education, Bulletin 74, No. 10 (Harrisburg: Department of Public Instruction, Commonwealth of Pennsylvania, 1940), 34 pp.

This bulletin presents an analysis of the education of teachers and supervisory officials in the public schools of Pennsylvania, in terms of formal schooling and professional experience. The study parallels previous studies dealing with salary and certification. It also includes discussion of the relationship of these factors.

ENGELHART, MAX D. *Report of the June and August 1940 Comprehensive Examinations and the September 1940 Placement and Exemption Tests of the Chicago City Junior Colleges* (Chicago: Department of Examinations, Chicago City Junior Colleges), 8 pp. Mimeographed.

The author presents an analysis of the test results for the comprehensive examinations administered in the Chicago City Junior Colleges.

HEAPS, WILLARD A. *School-Library Studies and Research 1936–38,* Reprinted from *The Library Quarterly,* X (July 1940), pp. 366–392.

The autho: presents a survey of the studies and research relating to school libraries for the three year period, 1936–38.

HOLY, T. C. *Trend in Public School Enrollment in Ohio Cities and Exempted Villages 1936–1940 Inclusive* (Columbus: Bureau of Educational Research, The Ohio State University, December, 1940), 16 pp. Mimeographed.

The author presents an analysis of enrollment trends for Ohio city and exempted villages for the five year period 1936–1940.

HOLY, T. C. *Costs Per Pupil in Average Daily Attendance in Ohio City and Exempted Village School Districts from July 1, 1939 to June 30, 1940* (Columbus: Bureau of Educational Research, Ohio State University, February, 1941), 20 pp. Mimeographed.

This report presents an analysis of the current expenses and total payments per pupil in average daily attendance in the 109 Ohio city and 79 exempted village school districts for the school year, 1939–40.

LAWSHE, C. H., and others. *Proceedings of the sixth Annual Guidance Conference Held at Purdue University November 29 and 30, 1940*, Studies in Higher Education XL (Lafayette, Indiana: Division of Educational Reference, Purdue University, January, 1940), 94 pp.

Contains papers as follows: How a public-relation program has helped to solve a trade-school guidance problem; guidance in Bedford High School; a summary of an experiment in a directed guidance program at the Lew Wallace School, Gary, Indiana; the Washington High-School plan of guidance, Washington, Indiana; guidance in 1940; evaluation of guidance; guidance and occupational information; guidance and social lag; the use of local resources in guidance; the state high-school testing program and the implications for guidance; and guidance and industry.

MCNEELY, JOHN H. *Fiscal Control Over State Higher Education*, Bulletin 1940, No. 8 (Washington, D. C.: U. S. Office of Education, Federal Security Agency, 1940), 49 pp.

Treats of control over appropriations before made by state legislature, control over appropriations after made by state legislature, and control over post-auditing of financial accounts of institutions. Summary. Bibliography.

PHILLIPS, GILBERT E. *The Constancy of the Intelligence Quotient in Subnormal Children*, Educational Research Series No. 60 (Melbourne, Australia: Melbourne University Press, 1940), 86 pp.

For subjects whose I. Q.'s range roughly from 50 to 80 there is a tendency for a general and substantial decline of I. Q. with repeated applications of a Binet test.

SALTER, MARY D. *An Evaluation of Adjustment Based Upon the Concept of Security*, University of Toronto Studies, Child Development Series, No. 18 (Toronto: University of Toronto Press, 1940), 72 pp.

The author presents a description of the construction and validation of scales for measuring extra-familial and familial security.

THORNDIKE, ROBERT L. *A Comparative Study of Children's Reading Interests* (New York: Bureau of Publications, Teachers College, Columbia University, 1941), 48 pp.

This monograph presents an instrument for studying the reading interests of children with conclusions drawn from its use.

ULRICH, R. P. *A Study of Arithmetic in Grades One to Six* (Toledo: D. H. Patten, University of Toledo, 1940), 42 pp. Mimeographed.

The author presents an analysis of research relating to the study of arithmetic, grades one to six inclusive.

ADMINISTRATION AND SUPERVISION

EELLS, WALTER CROSBY. "Status of the Junior College in the United States, 1940–41," *School and Society,* LIII (March 1, 1941), pp. 285–288.

A statistical report of the number of junior colleges, enrollments, and instructional staff.

BRINK, WILLIAM, GARFIELD, SOL, and WITTY, PAUL. "The Reading Interests of Negro High-School Students," *Educational Administration and Supervision,* XXVI (November, 1940), pp. 607–613.

The authors conclude that the reading of high school students is poor in quality and limited in quantity.

NUTTERVILLE, CATHERINE. "The Remedial Reading Program in Butte High School," *Educational Administration and Supervision,* XXVI (November, 1940), pp. 572–584.

The author describes a remedial reading program pursued in Butte, Montana, with the suggestion that the technique is applicable in other subject areas.

PSYCHOLOGY OF LEARNING AND TEACHING

SCATES, DOUGLAS E., and SPENCER, DALE K. "Retroactive Experiment on Effects of Military Training in High School," *School Review,* XLIX (March, 1941), pp. 195–205.

The authors present the results of a study of the effects of military training carried on in the New Hanover High School, Wilmington, North Carolina, from which they concluded that drill under certain conditions may be a wholesome element in a person's development and possibly in his mature life.

PUPIL GUIDANCE, WELFARE AND DEVELOPMENT

ANFINSON, RUDOLPH D. "School Progress and Pupil Adjustment," *Elementary School Journal,* XLI (March, 1941), pp. 507–514.

From an investigation carried out in four Minneapolis junior high schools, the author concludes that it has not been demonstrated that personality maladjustment is related primarily to failure in schools and proposes limited nonpromotions with a curriculum adapted to individual differences.

STATISTICS, MEASUREMENTS AND SCIENTIFIC TECHNIQUES

COLE, GERALD. "A Critical Analysis of the Results of the Betts Telebinocular Tests," *Elementary School Journal,* XLI (March, 1941), pp. 533–537.

The author presents statistical data on the validity of the Betts telebinocular tests.

NEMZEK, CLAUDE L. "Direct and Differential Prediction of Academic Success as Measured by the Stanford Achievement Test," *Journal of Social Psychology,* XIII (February, 1941), pp. 71–87.

The results indicate that chronological age at entrance to elementary school, education of father, education of mother, and economic status have little predictive value.

RICHARDSON, M. W. "The Logic of Age Scales," *Educational and Psychological Measurement,* I (January, 1941), pp. 25–34.

The author presents a critical discussion of age scales from which he concludes that they fail in many respects and possess no advantages over group tests.

WARD, WILLIAM D., REMMERS, H. H., and SCHMALZRIED, N. T. "The Training of Teaching-Personality by Means of Student-Ratings," *School and Society,* LIII (Februray 8, 1941), pp. 189–192.

The authors present the results of repeated application of the Purdue Rating Scale for instructors in which they get personality improvements.

WILLIAMSON, E. G., and BORDIN, E. S. "The Evaluation of Vocational and Educational Counseling: A Critique of the Methodology of Experiments," *Educational and Psychological Measurement,* I (January, 1941), pp. 5–24.

The authors present an analysis of things to be considered in evaluation studies in the field of vocational and educational counseling. Bibliography.

NEW TESTS

Chicago City Junior Colleges Comprehensive Examinations (June, 1940).

These tests include the following: Biological science 101–102, essay section; biological science 101–102, objective section; English qualifying examination; humanities 201–202, essay section; humanities 201–202, objective section; physical science 101–102, objective section; physical science 101–102, essay section; social science 101–102, essay section; exemption test, biological science, form F; exemption test, physical science, form F; English placement test, form D; exemption test, physical science, form F; and exemption test, biological science, form F.

CLARK, WILLIS W., TIEGS, ERNEST W., and THORPE, LOUIS P. *California Test of Personality — Intermediate Series* (Los Angeles: California Test Bureau, 1940), 8 pp.

The California Test of Personality has been designed to identify and reveal the status of certain highly important factors in personality and social adjustment usually designated as *intangibles* and which defy appraisal or diagnosis by means of ordinary ability and achievement tests.

TIEGS, ERNEST W., CLARK, WILLIS W., and THORPE, LOUIS P. *California Test of Personality—Adult Series* (Los Angeles: California Test Bureau, 1940), 8 pp.

The California Test of Personality, Adult Series, has been designed to identify and reveal the status of certain fundamental characteristics of human nature which are highly important in determining employability and general success in personal, social, or vocational relations.

Research News and Communications

Address all research news and communications to Carter V. Good, Teachers College, University of Cincinnati, Cincinnati, Ohio.

Major Issues in Education.—The projects summarized in this issue of the *Journal*, for the most part, represent attempts to deal with large social and educational problems of today. Five of the most pressing of these problems are: (1) to make public education serve more effectively the needs of democratic society, (2) to plan a program of education to meet the emergencies of national defense, (3) to adjust the secondary school curriculum to the large number of non-college and non-trade youth, (4) to develop valid techniques for appraisal of educational institutions and instruction, and through a program of implementation to apply in practice the results of research, and (5) to stimulate teachers in training and in service to develop the qualities of behavior necessary for a teacher in a democratic society.

Stanford Social Education Investigation.—This study has been described by I. James Quillen and Edward A. Krug.

The nature of a culture is determined by the behaviors of the individuals who compose it. A democratic culture requires individuals who have respect for other people, a concern for group problems, and a willingness to use intelligence in solving those problems. A wide distribution of such qualities of behavior is the best guarantee of the continued existence and development of a democratic society.

The Stanford Social Education Investigation was established January 1, 1939, with the purpose of attempting to strengthen American democracy by discovering ways to guide youth more adequately in the development of the characteristics of behavior essential to that end. The investigation is supported by a grant from the General Education Board and will continue until the end of 1943. In terms of personnel, the project consists of a group of more than 75 teachers and administrators in eighteen secondary schools in ten cities of the western part of the United States. This group is assisted by a staff of five at Stanford University, working under the co-direction of Grayson N. Kefauver and I. James Quillen of the School of Education.

The staff has no single pattern of educational content or procedures which it is attempting to sell to the participating teachers. Rather, it feels that its purpose is to stimulate the participating teachers, as individuals, to grow and develop in the qualities of behavior necessary for a teacher in a democratic society.

In order to provide the participating teachers with opportunities for development, the staff has utilized the following techniques: (1) summer workshops; (2) staff visits to teachers on the job; (3) providing teachers with specific help on problems, such as developing bibliogra-

phies, outlines, units, etc.; (4) a monthly *News Letter;* and (5) bulletins prepared by staff members on various topics in education related particularly to the work of the investigation.

One of the staff members has attempted to evaluate the development of the participating teachers during the academic year, 1939–40. It was found in general that the teachers had developed strength in philosophy and viewpoint, but had not as yet succeeded in becoming skilled in the techniques necessary for implementation of their philosophy.

This study of teacher development is only one of three projects in the research program of the investigation. Lavone Hanna, for example, is making a controlled study of the growth of pupils in the problems approach. Robert Bush is studying the factors involved in effective pupil–teacher relationships. Thus, the staff of the investigation, while it realizes that teacher development is significant, does not feel that such development is an end point in itself, but is important rather to the degree with which it succeeds in promoting pupil development. The teacher, however, is so significant an aspect of the environment of the pupil that little pupil growth can be expected unless the teachers themselves have a democratic philosophy of education and implement it with effective educational techniques and procedures.

The major purpose of the investigation, therefore, has been to point the way, if possible, to an improved social education for American youth. In doing so the staff has thought in terms of teachers, of pupils, and of the relationships between pupils and teacher. It has sought to provide an in-service education program for the participating teacher. This program of teacher education has not been carried on for its own sake, but is conceived as a major element in the possible contribution which the investigation may make to the development by American youth of those characteristics of behavior essential to the achievement of democratic values.

Occupational Adjustment Study.—From the study of six high schools last year, representing eight thousand former students having been out of school from one to five years, it was found that approximately 40 per cent had neither continued their formal schooling after they left the high school nor received training in a skilled trade or commercial work while they were in school. Although in some cases the schools were definitely trying to build a program which would fit the needs of this group, too often the youth had been shunted about between the more traditional curriculums, with little attempt at preparation for subsequent occupational adjustment.

The first step in working out a solution of this problem seems to be to get those responsible for the school program aware of and concerned about the needs of these youth. A second step is to determine the facts about the post-school experiences of such youth on the basis of which to build a more sensible program.

The Occupational Adjustment Study has contributed to this first step in the same way as many other studies have; it has called attention to and presented facts about the problem in its report,[1] and has

[1] Edward Landy and Others, *Occupational Adjustment and the School.* Bulletin of the National Association of Secondary-School Principals, No. 93, November, 1940. Washington: The Association.

gone even further. It has developed and refined a technique for use by the individual school to determine the facts about its own school-leavers. It is one thing to read about the general problem of youth in a report of a study carried on by strangers, but it is quite another thing to collect the same information about youngsters who have gone through one's own school.

The Implementation Commission of the National Association of Secondary-School Principals was so convinced of the desirability of having the individual schools attack the problem through a study of their own school-leavers that the work of the Occupational Adjustment Study for this year is being devoted to the introduction of the "Occupational Follow-up and Adjustment Service Plan" in schools throughout the country. This plan has been described briefly in various places, including the November issue of the *Journal of Educational Research*.

That the schools are concerned about the problems presented by these "educationally neglected" youth is evidenced by the fact that about 150 schools in all parts of the country are on their own initiative conducting occupational follow-up studies this year, using the materials of the Study for the purpose of studying the occupational problems of their youth in their own communities. This promises not only to bring such problems dramatically to the attention of many school people, but also to result in innovations and revisions in the school programs in the light of the facts discovered.

This statement was prepared by John R. Beery, associate director of the project.

Bureau of Educational Research in Science.—S. R. Powers describes the work of the Bureau of Educational Research in Science and of its cooperating teachers.

The growing irrelevance of present-day science teaching, as found in our secondary schools, to the needs of young people and society has been the target of increasing concern during the last decade. Our culture is witnessing one of the most rapid developments and changes in the history of Western civilization; and science (invention and technology) has been largely responsible for this unprecedented growth.

Commensurate research and implementation in the field of social and economic planning simply have not existed. Science itself—the dynamics of our power age—more or less without direction has "changed the world" by working on the levels of discovery and invention in discrete areas, with little attention to the necessities of long-range planning and social implementation. Youth, growing up in this society, faces problems of a type and number undreamed of when the curriculums of a less complicated time were developed. Yet curricular developments in science, designed to meet the needs of youth and society living in this age of stress and maladjustment, have been distressingly slow, despite the fact that recent studies[1] have shown that both

[1] "What People Think about Youth and Education," *Research Bulletin*, National Education Association, XVIII (November, 1940), 187–218. R. Will Burnett, *Opinions of Science Teachers on Some Socially Significant Issues: A Survey of Teacher Opinion and Its Implications for Teacher Education*. A report to the National Science Committee on Science Teaching, November, 1940.

the public and the teachers themselves recognize the urgency of the situation and the responsibility of the schools to face squarely the problems of our dynamic age and to bring the specialized abilities of teachers to bear on the study and solution of these problems.

In a determined effort to facilitate experimentation in the interpretation and implementation of this widely recognized responsibility of the schools, the Bureau of Educational Research in Science at Teachers College, Columbia University, has embarked upon a cooperative program with specialists in the various science disciplines, with educators, and with teachers who have had special training in science and are working in the public schools. Through financial support given by the General Education Board, it has been possible to make definite changes in science teaching so as to make it answer the needs of young people in our present-day society. Through various studies and analyses, a number of large areas of importance to young people today have been determined, problem areas amenable to scientific treatment and resolution. Source materials have been prepared by research specialists; these provide the available data with which to attack the problem.[2] Teaching suggestions, based upon evidences of the difficulties, interests, and confusions of young people, and upon teaching experiences in the area, have been prepared, not as units of study, but as guides in the experimental and continuous development of more adequate curriculums.[3]

Teachers educated in our colleges and universities have been trained along traditional lines which, for the most part, have left them incompetent to deal with the many urgent, unsolved problems of our time. Therefore, one of the most essential tasks in the cooperative study has been to give these teachers opportunity to study together those fields in which they accept responsibility. A group of about thirty such teachers met in the Curriculum Workshop at Teachers College last summer (1940) and studied on a mature level a number of these problems (for example, the problems of scientific production, distribution, conservation, and consumption of materials and services; and the problems of the human life span and the changing age groups of America).

During the current year the teachers are studying with the young people in their charge these same problems and are, through the offices of the Bureau, exchanging reports of their experiences, their successes and failures, and are enlarging their perspectives and clarifying and refining their procedures. These experiences, through publications of the Bureau, will be made available to teachers elsewhere. Thus research and the invention of ways to meet educational needs have been accelerated, and the fruits of the en-

[2] "The Science in Modern Living Series," published by the Bureau of Publications, Teachers College, Columbia University, includes: Paul B. Sears, *Life and Environment*, 1939; C. C. Furnas, *The Storehouse of Civilization*, 1939; F. L. Fitzpatrick, *The Control of Organisms*, 1940.

[3] "The Science in Modern Living Series," includes: Anita D. Laton and Edna W. Bailey, *Suggestions for Teaching Selected Material from the Field of Genetics*, 1939; and *Suggestions for Teaching Selected Material from the Field of Sex Responsiveness, Mating, and Reproduction*, 1940.

terprise will be available to teachers everywhere who have accepted the responsibility of their function as teaching scientists studying with young people the problems that are theirs and the society of which they are a part.

A Plan of Evaluation for Bennington College.—This plan has been described by Alvin C. Eurich, Stanford University, and director of the Evaluation Study, Bennington College, Vermont.

When Bennington College was founded in 1932 the administration made plans for a thorough evaluation of the effectiveness of their program. Grants during the past two years from the Whitney Foundation and the General Education Board made possible the appointment of an evaluation staff to develop and carry out the early plans.

The first question raised by this staff was: For whom and for what purposes was the college to be evaluated? The administration, the faculty, friends of the college, a small group of specialists in evaluation throughout the country, eminent educators, and students of higher education were all agreed. Any evaluation of a college such as Bennington should be conducted primarily for the purpose of providing faculty and students with sharper insights into the effectiveness of their work, which might lead to suggestions for improving the educational program.

To achieve this purpose, the evaluation staff with full cooperation from the administration, the faculty, the students, the alumni, and former students and the trustees set out to collect pertinent information and to develop an evaluation program that might continue after the special foundation grants expired.

In general, the study has been concerned with five basic questions. Without entering here into the many ramifications of each, these can be stated briefly as follows:

1. What is the nature of Bennington's total educational program?
2. How did the program as it now operates develop? What were the major steps in the process?
3. What are the purposes of the present program and how did these evolve? What are the major assumptions underlying these purposes?
4. To what extent are the major purposes being realized?
5. What changes do staff and students think should be made so that the college might achieve its aims more effectively?

These questions evolved from ratings by faculty and students of more than 150 that had been submitted in response to the query: "For what questions should the evaluation study seek answers?" Or to put it another way, "What information would be most valuable to you in arriving at a better appraisal of the Bennington program?"

In seeking answers to these questions, faculty committees with the help of the evaluation staff first set out to prepare an accurate description of the program. This involved collecting statements of procedures followed by individual faculty members and an analysis of the programs of students from the time the college opened its doors to the present. Each instructor and counselor and every senior student then stated, in an individual conference with a member of the evaluation staff, his objectives. During the conference an effort was made to obtain inter-

pretations of the objectives in terms of behavioral changes that the instruction was designed to produce or in terms of attainments for which the senior hoped. Later the same procedure was extended to freshmen.

The next step entailed bringing together all evidence that accumulated over a period of years, showing the extent to which the desired objectives were being attained. There were naturally gaps in the data, particularly in relation to the so-called intangibles. Special projects were designed to provide a more complete appraisal. For example, one of the major objectives of the program is to develop permanent interests. To collect information on the extent to which this objective is being achieved, the Interest Index prepared by the Evaluation Staff of the Eight-Year-Study for the Progressive Education Association was adapted to Bennington students. In addition, a follow-up study is now being made of graduates and former students in order to discover the extent to which they have pursued interests awakened in college.

Another example will reveal the efforts being made to show the degree to which some of the basic assumptions are being realized. Bennington College assumes that an educational program is more effective when a rather close relationship is established between instructors and students either in individual conferences or in small group conferences. It assumes further that the relationship established in the college community between students and their acceptance of community responsibilities brings about better adjustments. An adaptation of the Moreno technique is being used to study changes over a period of time in relation to these assumptions.

These are merely illustrations of the way in which the study is proceeding. A more complete description would involve the work of special faculty committees concerned with the developing educational program at Bennington, the direct and concrete experiences such as those provided through the winter period, the social studies survey, and the community government.

By the end of the current year a progress report will be issued. Aside from providing a summary of extensive data in relation to objectives, the report will reveal how, in this evaluation project, faculty and students are cooperating in studying themselves for the purpose of gaining a more adequate appraisal of their educational program.

School Plant Research.—T. C. Holy of Ohio State University describes a contribution to the area of appraisal and implementation.

1. The Committee on School Plant Research of the American Council on Education is continually seeking to promote and sponsor research in the school building field. It has a grant of $12,000 for a study of equipment specifications, which is now under way in cooperation with the Interstate School Building Service at Peabody College, and with the United States Bureau of Standards. Also, the committee has under way another comprehensive study of sanitary facilities in a group of school buildings distributed throughout the country.

2. In an attempt to bring to educators and others the need for research in the field of school buildings and equipment, the committee issued in April, 1939, one of the American Council on Education Studies entitled "School Buildings and

Equipment." In this bulletin there is set forth an extensive list of areas in the school building field in which research is urgently needed.

3. In the matter of getting research findings into practice, the committee is in an unusually advantageous position. Of its present membership of eleven, eight are members of the National Council on Schoolhouse Construction—five of whom are past presidents of that organization, and one the present secretary–treasurer. The membership of this National Council on Schoolhouse Construction consists of directors of divisions of schoolhouse planning in state departments of education and persons occupying similar positions in large cities. In a study of the duties which the members of this organization have, it is found that they have the major responsibility for the planning of the school buildings for the children of about two-thirds of the total population of the United States. Therefore, with this arrangement, the committee has an unusual opportunity for translating its findings into practice.

Teacher Education.—In a sense, the chief impact of the Commission on Teacher Education during the past year has been on the problems of democratic leadership and all-institution participation in connection with the twenty collegiate institutions, fourteen public school systems, and three statewide programs associated in its work. This emphasis has been conveyed primarily by the Commission's chosen method of work. The semi-annual meetings of the administrators and local coordinators from the cooperative study in teacher education, in January and October 1940, and the five-week summer workshop in teacher education held on the campus of the University of Chicago were operated in such a way that representatives of universities, liberal arts colleges, teachers colleges, and public school systems could meet informally and discuss problems of mutual concern. Administrators, college professors, and classroom teachers from all parts of the country exchanged views and stimulated each other's thinking in this way. The October conference was specifically organized around the problems of cooperative methods and the place of leadership in a democracy.

Evidence is accumulating to the effect that, as a result of participating in the Commission's studies, a decided shift is taking place within many cooperating institutions in the direction of increased willingness on the part of administrators to invite the faculty, and in turn of faculty members to invite students, to share in relevant deliberations. Another trend is in the direction of greater general participation within the several cooperating units in the Commission's work, and of a resulting increased sense of institutional group consciousness. While there is of course considerable difference in this regard between institutions, several have made remarkable progress. That this claim is no idle-wish thinking is attested to, at any rate as far as the seven cooperating teachers colleges are concerned, by the independent judgment of a special investigating committee of two, appointed by the American Association of Teachers Colleges.

Joint study of some really significant issues has been the characteristic opening wedge for this democratic group functioning. It is being repeatedly discovered that individual or departmental possessiveness in a given institution, or rivalry

between institutions, tends first to be challenged and then to yield, though not without resistance, to the liberating force of some shared larger end. Thus, a co-operative study of the needs of childhood and the way human growth takes place, or a joint survey of local community problems, has worked to promote organic institutional as well as individual growth. Progress has been sometimes impeded, on the other hand, as much by the very stimulus of the Commission's program and the eagerness to make changes before adequate analysis has taken place, as by the force of inertia or the limitations of human nature.

The Commission's evaluation service has been in operation since March, 1940. The concept is understood to mean helping an institution to appraise its progress by the standard of its own aims. The process consists first of getting representative groups to formulate or re-examine their goals, then to look at their practice with these objectives in mind and to evaluate its strength and weakness in carrying them out, then to modify practice or aims as required, and to develop new practice to serve the new goals. Theoretically, there is and should be no end to self-appraisal of this kind. Obviously this emphasis, like all other phases of the Commission's work, depends for its value on the degree of significant participation obtained for the institution as a whole.

This news item was prepared by Helen E. Davis, associate in charge of the clearing house of the Commission.

National Teacher Examinations. — A penetrating analysis of the merits and dangers of a national system of teacher examinations has been prepared by David G. Ryans of the National Committee on Teacher Examinations. He takes up first this question: "Is there danger of lowering the standards of teacher preparation during the present emergency? If so, how can it be prevented?"

The demands of national service are likely to be heavily felt by the teaching profession, many of its competent members accepting responsibilities in fields of their specialization where the national government needs personnel, others volunteering for military training, and still others resigning their teaching duties for more remunerative positions occasioned by the emergency. In the face of such a situation the school administrator is likely to find replacement difficult and his choice relatively limited, so that he may feel he is forced to select teachers much less able than those chosen under more favorable conditions. Actually, it is undoubtedly true that good teachers still will be available, although circumstances may be such that they do not come to the attention of many administrators seeking new personnel. By encouraging National Teacher Examination candidates with good records to apply for positions, superintendents and teaching applicants alike will be benefited by the permanent file of teacher examination results maintained by the national committee. Certainly, personality and social factors, classroom skill, and other attributes must be taken into consideration together with examination results. But if the administrator recognizes that the National Teacher Examinations provide a clearing house and reservoir for information concerning the highly important intellectual and academic qualifications of a teacher, and employs the examination records in selection, there can be some assurance that high standards in

personnel will not be materially lowered by replacements during the emergency.

A second question is: "What are the merits and dangers of a centralized or national system of teacher examinations for use in selection and appointment of teachers?" Among the values or merits of a National Teacher Examination program are the following:

1. Assurance to the public that teachers selected with regard to credentials that include teacher examination results will be intellectually alert and professionally qualified, as well as being personable, social, and skilled in directing the learning experiences of children.

2. Provision of more readily interpretable facts regarding a prospective teacher's abilities, made possible by the comparability of the teacher examination estimates of intellectual and academic qualifications from year to year and from one community to another.

3. Assistance to able and forward-looking teachers who wish to avail themselves of opportunities for advancement either within their own school systems or in other communities.

4. Assistance to professionally-minded in-service teachers and to prospective teachers in extending their preparation and education; providing them with a profile of their strengths and weaknesses, and acquainting them with the need for further study and attention to the latter.

5. Assistance to the teacher-education institution through provision of a comprehensive picture of each graduate's academic and intellectual abilities, which may serve with other factors as a means of evaluating both the student and the institution or department.

Potential dangers of a national teacher examination program should be considered. The National Teacher Examination project is no exception to the commonly observed rule that few undertakings, regardless of merits, are without potential dangers. If the merits of a project appear to be sufficiently significant, the possible dangers are accepted with the plan's adoption. Constant attention and study are given to the dangerous elements, so that they must remain "potential dangers" and never detract from the acknowledged merits or values. The National Committee on Teacher Examinations has, from the beginning, recognized "potential dangers" in a national system of examinations, but the committee and staff aim to be constantly on guard so that neither they nor those who are using the examination results will allow the dangers to become real. The following may be suggested as possible dangers which are to be guarded against:

1. The possibility of candidates cramming or being coached for the examinations. Items making up the national teacher examinations are, insofar as possible, functional and relate to applications rather than merely to facts. The effects of highly specific preparation and coaching are greatly reduced by use of this type of item. Further to obviate this type of danger, copies of previously administered national teacher examinations are not made available for any purpose. The national committee urges teacher-education institutions to be constantly alert to this danger. Many teacher-education leaders who have been consulted agree that this danger can be avoided.

2. There is the possible danger that administrators may accept the national teacher examinations as an "easy way" of selecting teachers, or that they may allow themselves to be influenced wholly by

test results at the expense of other factors in judging an applicant. In its publications and in its consultation service with superintendents the national committee emphasizes the significance of personal and social factors, teaching skill in the classroom, mental health, and other factors which relate to successful teaching, in addition to academic and intellectual abilities measured by the examinations. Superintendents who have been consulted have shown a clear awareness of the importance of the factors not measured by the examinations, and many have indicated that the use of the national committee examinations would enable them to give more effective attention to the appraisal of these other factors.

3. There is the danger that a national system of examinations may eventually influence the curriculum in teacher-education institutions, tending to produce undesirable rigidity and resistance to change in the light of new developments. The national committee has guarded against this danger. Each year new forms of the examinations are prepared. Each test is published in its final form only after criticism of the outline and items by leaders in teacher education, authorities in subject-matter fields, and supervisors in school systems. The examination system has been set up so that the new annual editions of the tests may readily reflect the changes and developments in educational viewpoints, and discoveries and advances in subject-matter fields.

4. There is the danger that a national examination system may bring about less emphasis on classroom methods and techniques, and upon such qualities as initiative and imagination on the part of the teacher. The national committee wishes to encourage a greater, rather than a lesser, amount of attention to "practice teaching" and to experience in the evaluation of prospective teachers' qualifications. The ability to answer application and judgment questions involving classroom situations, such as are included in these tests, is most effectively gained through actual classroom experience. The examinations are not intended to supplant, but to supplement other available information.

5. There is the danger that the national system of examinations may become a commercial enterprise. By nature of the control of the test-producing and administering agencies by a non-profit, service organization (the American Council on Education) such a possibility is obviated. The work of the first years of the examinations was partially subsidized by the Carnegie Foundation for the Advancement of Teaching. The entire income from the examination fees and from other sources will be used for the development and improvement of teacher examination and selection techniques, for the preparation of new tests, for the administration of the examinations, and for the maintenance of a file of examination results where the candidate's record will be available to him upon request. Examination fees will be set at as low a figure as possible.

A national system of examinations which is constantly alert to the potential dangers and which actively seeks to avoid them can be reasonably expected to contribute materially to the improvement of teaching.

The Doctorate at New York University.—A dissertation of 1939 at New York University entitled, "The Doctorate of Philosophy in Education and its Administration at New York University,"

has been completed by Signe Elizabeth Hagelthorn, who prepared the following summary. The increasing demand for teachers and administrators possessing the doctoral degree focused the attention of graduate schools on the widespread dissatisfaction with the traditional requirements. Since the Doctor of Philosophy degree emphasized research almost to the exclusion of professional preparation for teaching, a professional differentiation of the degree seemed inevitable. The challenge to modify traditional requirements to serve modern needs in education, without sacrifice of accepted standards for the doctorate, was clear. Among the institutions which took up the challenge was the School of Education of New York University.

The problem of this dissertation was to determine the validity of contemporary criticism of the changes made in the requirements for the new "professional" doctorate in philosophy, involving exclusion of the liberal arts curriculum in favor of the professional requirements on both undergraduate and graduate levels. The extent of modification of the policies of New York University in the administration of the Ph. D. in Education, especially during the early period of the School of Education, was included in this criticism.

As a background for interpreting the evolution of graduate degrees, a historical study of the origin of organized education and of the earliest efforts to standardize academic and professional requirements, including our modern, complex institutional practices, was presented. To secure factual information, upon which to base critical judgment of the extent to which such criticism is or is not justified, a study of the doctoral degrees granted by the School of Education of New York University during its first decade was made. The extent to which the School of Education found it necessary to modify its policies in granting such degrees was analyzed in the light of its aims and standards.

The tendency to "professionalize" the doctorate is a reflection of the ancient practice of licensing scholars to teach. From the license developed the idea of degrees, which later became symbols of scholarly attainments in arts and sciences. The standardized Ph. D. was symbolic of research in these fields. A trend away from the purely academic curriculum to one of applied arts and sciences in the field of education was precipitated by the demand for professional preparation in higher education. The degree of Doctor of Philosophy in Education is the modern conception of the highest requirement in the applied curriculum for professional education. A newer development is the degree of Doctor of Education in response to the demand for superior skill in teaching, with less emphasis on research.

The criticism that the advanced philosophy degrees in education at New York University did not require a liberal arts education was to a considerable extent refuted by the results of the study. Of the 216 doctoral candidates of the first decade of the School of Education, 180 were graduates of colleges of liberal arts and sciences. Only 25 were graduates of normal schools (professional undergraduate curriculum), and these proceeded to the baccalaureate without much occupational delay.

Flexibility in the administrative procedure in regulating individual requirements was contingent upon the lack of homogeneity among the doctoral candidates. Recognition was accorded outstanding achievements in the field of education. Such contributions to the advancement of education were accepted in lieu of a part of the quantitative requirement. The results of the study suggest that the motives for the deviations from standard practice were in keeping with the aims, as defined by the school at the time of establishing its graduate department.

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